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THESIS

INTEGRATED LOGISTICS SUPPORT IN SPECIAL OPERATIONS AVIATION - A CASE STUDY OF THE MH-60K AND MH-47E

by

Scott A. Jacobsen

June 1996

Principal Advisor: John Dillard

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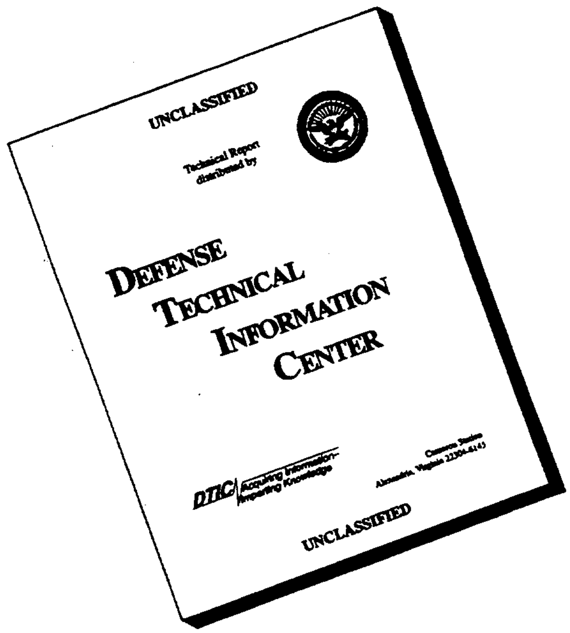

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13. ABSTRACT *(maximum 200 words)* This thesis identifies the major factors faced by the Program Manager in developing and implementing the integrated logistics support plan (ILSP) for the U.S. Army's Special Operations Aircraft (SOA), the MH-60K and MH-47E. The SOA Program had many unique characteristics which made it a prime candidate for identification of major factors and development of lessons learned. Two of those unique characteristics are the facts that it was designated a nondevelopmental item (NDI) acquisition, and the fact that it is an extremely low density weapon system. Effective integrated logistics support (ILS) planning poses a challenge in "normal" developmental programs. Ensuring that ILS is handled effectively in low density NDI acquisitions can be a significantly more difficult challenge for the acquisition professional. This thesis develops a case study of ILS in the unique environment of the SOA Program. It also analyzes four maintenance specific ILS elements in an attempt to identify major factors that significantly impacted the development and implementation of the SOA ILSP. From these major factors, numerous lessons learned are developed. Some of the more important lessons learned are that: Sustainment of low density weapon systems is far more complicated and expensive through separate small Program Management Offices than it is through existing Program Management Offices; The density of the weapon system being procured is one of the most important factors to consider when making key ILS decisions; and, Logistics Support Analysis tailoring and use are critical to establishing and implementing successful ILS in weapon systems. Study of the major factors and lessons learned presented in this thesis should improve the future development and implementation of ILSPs in Special Operations Aviation programs and NDI programs as a whole.

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INTEGRATED LOGISTICS SUPPORT IN SPECIAL OPERATIONS AVIATION- A CASE STUDY OF THE MH-60K AND MH-47E

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ABSTRACT

This thesis identifies the major factors faced by the Program Manager in developing and implementing the integrated logistics support plan (ILSP) for the U.S. Army's Special Operations Aircraft (SOA), the MH-60K and MH-47E. The SOA Program had many unique characteristics which made it a prime candidate for identification of major factors and development of lessons learned. Two of those unique characteristics are the facts that it was designated a nondevelopmental item (NDI) acquisition, and the fact that it is an extremely low density weapon system. Effective integrated logistics support (ILS) planning poses a challenge in "normal" developmental programs. Ensuring that ILS is handled effectively in low density NDI acquisitions can be a significantly more difficult challenge for the acquisition professional. This thesis develops a case study of ILS in the unique environment of the SOA Program. It also analyzes four maintenance specific ILS elements in an attempt to identify major factors that significantly impacted the development and implementation of the SOA ILSP. From these major factors, numerous lessons learned are developed. Some of the more important lessons learned are that: Sustainment of low density weapon systems is far more complicated and expensive through separate small Program Management Offices than it is through existing Program Management Offices; The density of the weapon system being procured is one of the most important factors to consider when making key ILS decisions; and, Logistics Support Analysis tailoring and use are critical to establishing and implementing successful ILS in weapon systems. Study of the major factors and lessons learned presented in this thesis should improve the future development and implementation of ILSPs in Special Operations Aviation programs and NDI programs as a whole.

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I. INTRODUCTION

This thesis concentrates on the issues associated with integrated logistics support (ILS) in Special Operations Aviation systems. Specifically, it analyzes the Integrated Logistics Support Plan (ILSP) of the Special Operations Aircraft (SOA) Program and establishes practical "lessons learned" based on the formulation and implementation of this plan.

A. BACKGROUND

In April of 1986 the SOA Program was initiated by Headquarters, Department of the Army (DA) in response to the Department of Defense (DoD) Special Operations Forces (SOF) Airlift Report and the SOF Expedited Essential Required Operational Capability. This program was initiated to fulfill the operational requirement of a "US Army aircraft. . . capable of performing clandestine, deep penetration airlift missions in adverse weather with limited lighting and visibility during night or day conditions over all types of terrain." [Ref. 1]

This validated requirement was based on the perceived limited ability of the UH-60L (Blackhawk) and CH-47D (Chinook) helicopters to perform special operations missions. The limitations of these aircraft were grouped into three broad categories: (1) performance characteristics; (2) vulnerability to threat weapon systems; and (3) limited self-deployability. In order to overcome these limitations, the SOA Program began the design, integration, modification and qualification of a Mission Equipment Package (MEP).

The MEP consisted of an Integrated Avionics Subsystem (IAS) to enhance communications and navigation, a multimode radar (MMR) to include terrain following and terrain avoidance capability, an improved Aircraft Survivability Equipment (ASE) suite,

increased armament to include upgraded suppressive weapons, the addition of external and internal fuel tanks and air-to-air refueling provisions, upgraded and improved engines (CH-47D) and an upgraded transmission (UH-60L). When fielded, the UH-60L and CH-47D aircraft would be redesignated as the MH-60K and MH-47E. [Ref. 1] (See Figure 1.1 and Figure 1.2.)

The SOA Program was obviously not a traditional "new start," developmental program. Rather, it was a modification and integration type program. Because of this, the SOA Program was designated a nondevelopmental item (NDI) program in accordance with Army Regulation (AR) 70-1, "Army Acquisition Policy." [Ref. 2]

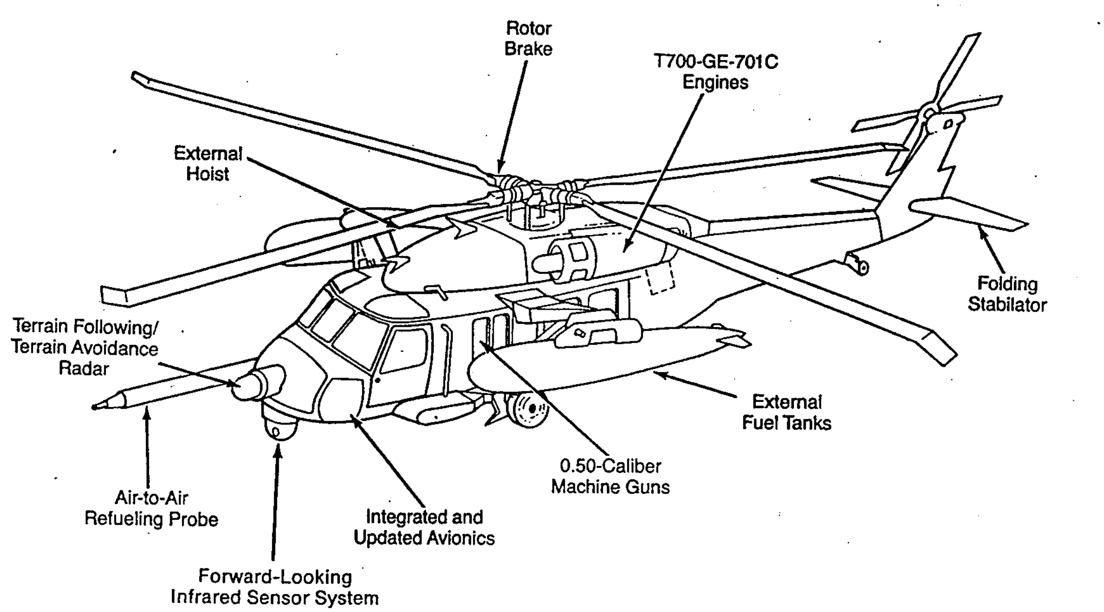

Figure 1.1. MH-60K Configuration After [Ref. 3]

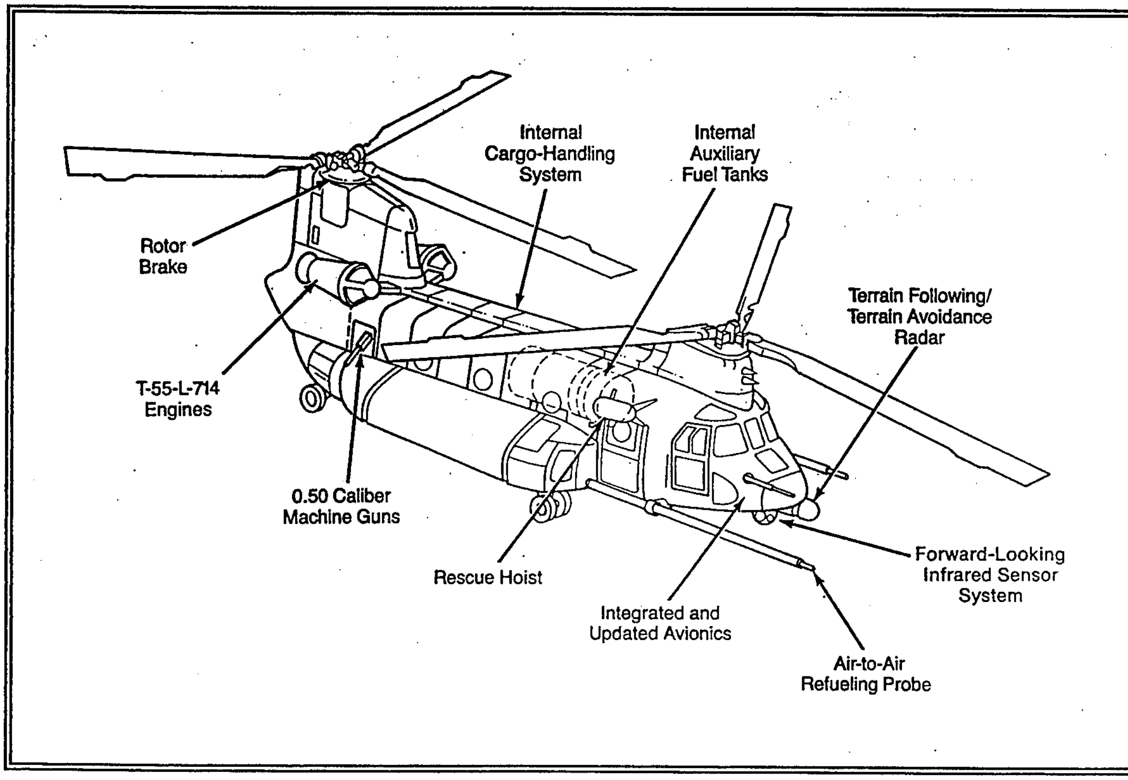

Figure 1.2. MH-47E Configuration From [Ref. 3]

Although the use of NDIs in the acquisition process is not a new concept, their use has received a great deal of emphasis in recent years. This increased emphasis is a direct result of Congressional mandates to use more commercial business practices in the acquisition of weapon systems. With this "new charter," it is critical that acquisition professionals have a firm understanding of the many benefits and challenges that NDI acquisitions provide to the systems acquisition process and to the process user.

Some of the benefits of using an NDI acquisition strategy include: application of state-of-the-art technology to current requirements; quick response to operational needs; elimination or reduction of research and development costs; and reduction of cost, schedule, and performance risks. Some of the challenges that NDI acquisitions present include: the

possibility of items developed for other than DoD needs not meeting all requirements; mission performance trade-offs being required to gain advantages from pursuing NDI alternatives; product modifications complicating configuration management; questionable continued product availability; and, the subject of this thesis, challenging logistics supportability. [Ref. 4]

Effective ILS planning and implementation pose a challenge in developmental programs, even with all of the training and guidance that acquisition personnel receive. Ensuring that ILS is handled effectively in NDI acquisitions can be a significantly more difficult challenge to acquisition personnel because of the differences in the NDI acquisition process. First and foremost among those differences is the compressed acquisition life cycle.

The compressed acquisition life cycle effectively reduces the amount of time available for planning and developing organic logistics support. ILS activities that normally take place during the demonstration and validation (DEMVAL) and the engineering and manufacturing development (EMD) phases of the acquisition life cycle must be accelerated to ensure that effective support is developed or procured for the system. Additionally, logistics support may be adversely impacted by rapidly evolving NDI hardware and software since DoD may not be acquiring sufficient technical data and technical-data rights to maintain configuration control of commercial items. [Ref. 4]

Acquisition personnel must be sensitive to these, and other, challenges and ensure that they are addressed early in the acquisition process. They must understand that implementing effective ILS for NDIs will probably require a departure from the "normal" procedures of a developmental item acquisition. The "non-normal" procedures required to effectively develop

and implement ILS within an NDI program establish the theoretical framework of this thesis. The SOA Program was my vehicle for exploring that concept.

B. OBJECTIVE

The objective of this thesis is to identify and examine the major factors in the SOA Program that had a significant impact on the development and implementation of the Program's ILSP. From this, I will develop ILS related lessons learned that will benefit acquisition managers and their staffs in the effective development and implementation of ILSPs for their own low density NDI programs.

A secondary objective of this thesis is to develop possible solutions to current ILS implementation problems with the MH-60K and MH-47E. These solutions will benefit all personnel directly involved in the logistics support of these aircraft. (The solutions developed will not be disclosed in this thesis. Instead, the solutions will be provided directly to the Assistant Program Manager (APM) for Material Readiness and Logistics at the Technology Applications Program Office (TAPO).)

C. RESEARCH QUESTIONS

In pursuing the objective(s) of this thesis, the following primary research question guided my efforts: What major factors in the SOA Program had a significant impact on the development and implementation of the Program's ILSP and what lessons can be learned from those factors?

The subsidiary research questions that I used to determine the answer to the primary research question are:

1. What is integrated logistics support; what is nondevelopmental item acquisition; and, how does integrated logistics support differ in nondevelopmental item acquisition?

2. What is the Special Operations Aircraft Program, and to what extent are the aircraft in this program modified over regular Army aircraft?

3. What are the specifics of the Special Operations Aircraft Program's Integrated Logistics Support Plan?

4. Has the Special Operations Aircraft Program's Integrated Logistics Support Plan been successfully implemented?

5. What factors were identified as critical during the development and implementation of the Special Operations Aircraft Program's Integrated Logistics Support Plan?

6. What Integrated Logistics Support related lessons learned can be gained from the Special Operations Aircraft Program?

D. SCOPE, LIMITATIONS, AND ASSUMPTIONS

1. Scope

The main thrust of this thesis is on ILS. Specifically, the study concentrates on ILS within nondevelopmental programs. To further narrow the scope of research, I concentrated my efforts on the peculiarities of SOF aviation acquisition programs, and the SOA Program in particular. SOF aviation acquisition programs generally consist of small quantity purchases of technologically advanced hardware. This combination of factors increases the difficulty of ILS support beyond that of a "normal" NDI program and warrants consideration on its on accord.

In this thesis I establish a baseline for ILS by describing what DoD and DA consider to be ILS. I also provide a description of NDI acquisitions in order to set the ground work for a description of ILS in nondevelopmental programs. Next, I provide a description of the SOA Program, the aircraft involved in the Program, and the Program's ILSP. This will provide the

reader with an understanding of the technology involved in the Program as well as an appreciation for the depth of ILS planning that took place in the Program. After this foundation information is presented, I present an analysis of the adequacy of the SOA Program's ILSP. This analysis was based on the level of success achieved during the implementation of the ILSP on the fielded aircraft. From this analysis, I establish lessons learned that may be applicable to other acquisition programs.

2. Limitations

The analysis of the SOA Program's ILSP was limited to the following ILS elements: (1) Maintenance Planning; (2) Supply Support; (3) Support Equipment; and (4) Technical Data (maintenance publications only). The remaining six ILS elements were not analyzed for the following reasons: (1) Manpower and Personnel was not analyzed because there was no increase in manpower and no increase in military operational specialties deemed necessary; (2) Computer Resources Support was not analyzed because it was managed under a separate document and a separate functional area of the PMO; (3) Training and Training Support was not analyzed in an intentional effort to limit the scope of the analysis to maintenance and supply related activities; (4) Facilities was not analyzed because existing UH-60L and CH-47D facilities were deemed adequate for the SOA; (5) Packaging, Handling, Storage, and Transportation was not analyzed because there was no change anticipated in this area; and (6) Design Interface was not analyzed because of the limited influence it has in NDI acquisitions.

Other areas that were intentionally not explored in this thesis include: ILS and its relation to the systems engineering process; test and evaluation (T&E) considerations in the ILS process; ILS funding considerations; ILS transition activities from one phase of the

acquisition life cycle to the next; Continuous Acquisition and Life-Cycle Support (CALS); and the specifics of Reliability, Availability, and Maintainability. These areas, while extremely important, are extensive enough to warrant independent analysis.

This thesis is further limited by the fluid state of the acquisition process in the late 1980s and early 1990s. The names of some of the ILS elements have changed since the SOA Program's development of the ILSP. Some terminology has changed with the passage of time. Etc... In an attempt to negate the effect of these changes on this thesis, I used the most current terminology and methodology in writing it. The one exception to this comes with the intentional nonuse of the new DoD 5000 series (dated 11 October 1995). These directives implement the many changes associated with the Federal Acquisition Streamlining Act (FASA). While I was writing this thesis, the DoD 5000 series was still in draft form; therefore, I chose to utilize the most recent, nondraft, versions of the DoD 5000 series publications.

3. Assumptions

The primary assumption that I made in this thesis is that logical and useful ILS lessons learned can be derived from an analysis of a recently implemented ILSP. Another key assumption associated with this first assumption is that personnel intimately involved with the implementation of an ILSP are the most qualified to provide realistic, current, and relevant insight into the ILS process.

Another assumption that I made in this thesis is that the reader has a working knowledge of the DoD acquisition process. Therefore, no effort was made to explain the requirements generation process, the phases of the acquisition process, or the ILS related considerations in those phases.

The final assumption that I made in this thesis is that the lessons learned from this study will still be applicable after the full implementation of the FASA. Even with the streamlining of the acquisition process, the basic ILS planning and implementation elements remain intact and critical to the successful, and financially supportable, fielding of modern weapon systems.

E. METHODOLOGY

I conducted this thesis as a case study, with an analysis of the implementation of the SOA Program's ILSP. The research methodology for this thesis consisted of an extensive literature review, a detailed analysis of SOA Program documentation, and in-depth interviews with SOA Program knowledgeable personnel.

The first subsidiary research question was answered through a review of the latest available DoD Directives (DoDD), Army Regulations (AR), Department of the Army Pamphlets (DA Pam), Research Reports and Papers, and defense related periodicals. I obtained these references from the Defense Logistics Systems Information Center, the Defense Technical Information Center, the Defense Systems Management College, and the Naval Postgraduate School's Dudley Knox Library.

The second two subsidiary research questions were answered through a critical analysis of various SOA Program documentation. This documentation included the Program's ILSPs, Acquisition Plans, and Material Fielding Plans (MFP). These documents were provided by the Technology Applications Program Office (TAPO) in St. Louis Missouri. TAPO took over responsibility for the SOA Program in April of 1995 when the SOA Program Management Office (PMO) was closed.

The final three subsidiary research questions, as well as the primary research question, were answered through the use of personal interviews. These interviews were conducted with previous SOA PM personnel, TAPO personnel, Boeing/Sikorsky Aircraft Support (BSAS) personnel, and 160th Special Operations Aviation Regiment (Airborne) (SOAR(A)) personnel. BSAS personnel are currently responsible for providing "peculiar item" intermediate and depot level maintenance and supply support for the MH-60K and MH-47E at Ft. Campbell Kentucky. 160th SOAR(A) personnel are the "user" personnel of these two systems and are responsible for the unit and "common item" intermediate level maintenance and supply for the two airframes.

F. DEFINITIONS AND ACRONYMS

DoD and Army definitions and acronyms used in acquisition management and the SOA Program are provided throughout the thesis where needed. Appendix A provides a consolidated list of acronyms.

G. ORGANIZATION OF STUDY

The remainder of the study is organized as follows: Chapter II is named - "Background." This chapter provides the general background information necessary for the reader to comprehend the remainder of the study. Specifically, ILS is described, NDI acquisitions are described, and ILS within NDI acquisitions is described.

Chapter III is named - "Case Description: Integrated Logistics Support in the Special Operations Aircraft Program." This chapter describes the systems and technology integrated into the SOA. It also describes the ILSP for these unique aircraft.

Chapter IV is named - "Analysis and Identification of Major Factors." This chapter analyzes the adequacy of the SOA Program's ILSP through the use of interviews conducted with program personnel, support personnel, and user personnel. It also provides a list of critical development and implementation factors derived from the analysis.

Chapter V is named - "Lessons Learned and Conclusions." This chapter draws the study together, presents logically drawn lessons learned and conclusions that other acquisition professionals might use in the development of ILSPs in low density, NDI programs. Additionally, the research questions are answered in this section and areas for further research are identified.

II. BACKGROUND

A. INTRODUCTION

The primary purpose of the acquisition process is to develop and deploy cost effective systems that are capable of performing their intended functions. The functional area of integrated logistics support (ILS) is responsible for ensuring that those systems are cost effective in terms of life cycle costs (LCC) and that they can repeatedly perform their intended functions without burdensome maintenance and logistics efforts.

The tasks associated with ILS that ensure that a system is capable of performing as stated are challenging in all types of acquisitions. They are especially challenging in non-developmental item (NDI) acquisitions because of the unique differences in the process. This chapter explores some of the challenges facing ILS in NDI acquisitions.

The chapter begins with a section on the generic ILS process. This section defines ILS and it's relationship to LCC and Operation and Support (O&S) costs. It also examines the ILS planning process, the Logistics Support Analysis (LSA) process, and the ILS elements. The next section briefly describes the NDI acquisition process and it's role in defense acquisition today. The final section integrates the two previous sections and examines the challenges and considerations of ILS in NDI acquisitions.

The purpose of this chapter is threefold. First, it provides the reader with a basic understanding of the ILS process. Second, it provides the reader with a basic understanding of NDI acquisitions. And finally, it provides the reader with an understanding of some of the challenges that face the ILS process in NDI acquisitions.

B. INTEGRATED LOGISTICS SUPPORT

1. Background

a. The Acquisition Logistics Problem

Following World War II, the United States and the Soviet Union entered into an era of technological competition known as the Cold War. The Cold War pitted the Soviet Union's strategy of quantity against the United State's strategy of quality. The Soviet Union believed in building tough, technically simple systems which could be produced in large numbers. The United States, on the other hand, relied on the projected higher kill ratios associated with the latest technological solutions. [Ref. 5]

By the middle of the 1960s, the United States discovered that their commitment to high technology had resulted in systems that were fragile, expensive to support, and didn't last long when employed. The F-111 aircraft is the classic example. "Brilliant in concept, it was formidable on the rare occasion that everything worked and lasted for the duration of a mission. The amount of personnel and equipment required (to maintain it) were unprecedented, and the support costs were shocking." [Ref. 5]

It was obvious that a new philosophical approach was needed. The "new philosophy" was stated simply as: "influence the design of a system from its conception so that support was considered and life cycle costs minimized." [Ref. 5] Thus was born the concept of <u>integrated</u> logistics support.

b. Life-Cycle Costs

Prior to the new philosophy described above, life-cycle costs, especially O&S costs, had little visibility. This cost visibility problem can be related to the "iceberg effect"

illustrated in Figure 2.1. The importance of the new philosophy on the iceberg effect was that it emphasized the importance of considering not only the system acquisition cost, but other costs as well.

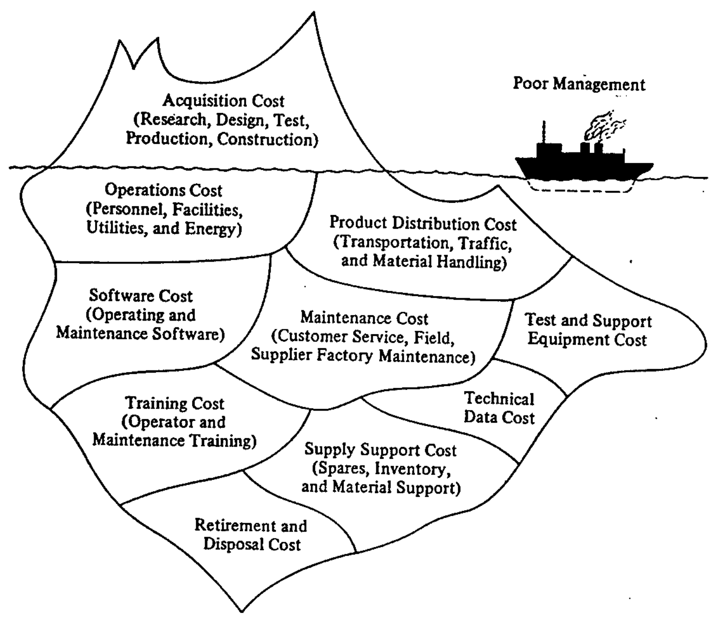

Figure 2.1. Total Cost Visibility From [Ref. 6]

In addition to considering LCC in the design of the system, the new philosophy also called for influencing the design early in order to minimize the LCC. Experience has shown that a major portion of the projected LCC for a system comes from the consequences of decisions made early in the systems life-cycle. Figure 2.2 shows that, while the greatest portion of LCC may result from activities occurring late in the systems life-cycle (i.e. O&S costs (See Figure 2.3 and Table 2.1)), the greatest opportunity to influence those costs is realized during the early phases of a program. "Decisions relating to the evaluation of

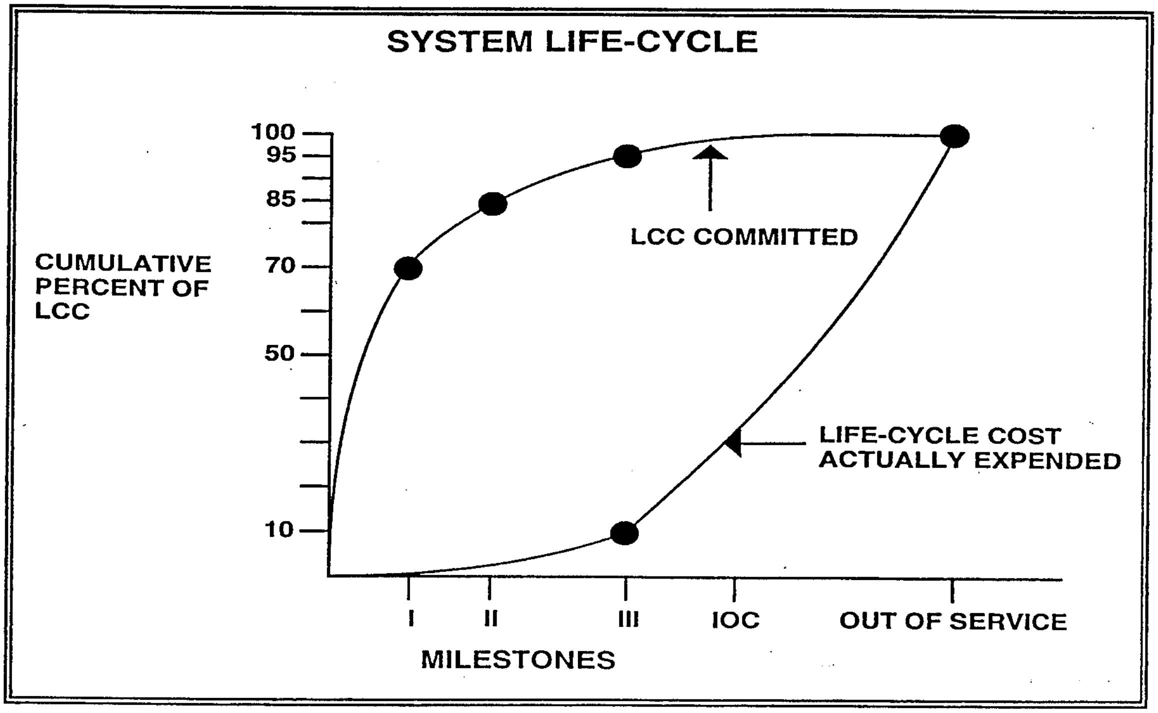

Figure 2.2. Typical Life-Cycle Cost Commitment From [Ref. 7]

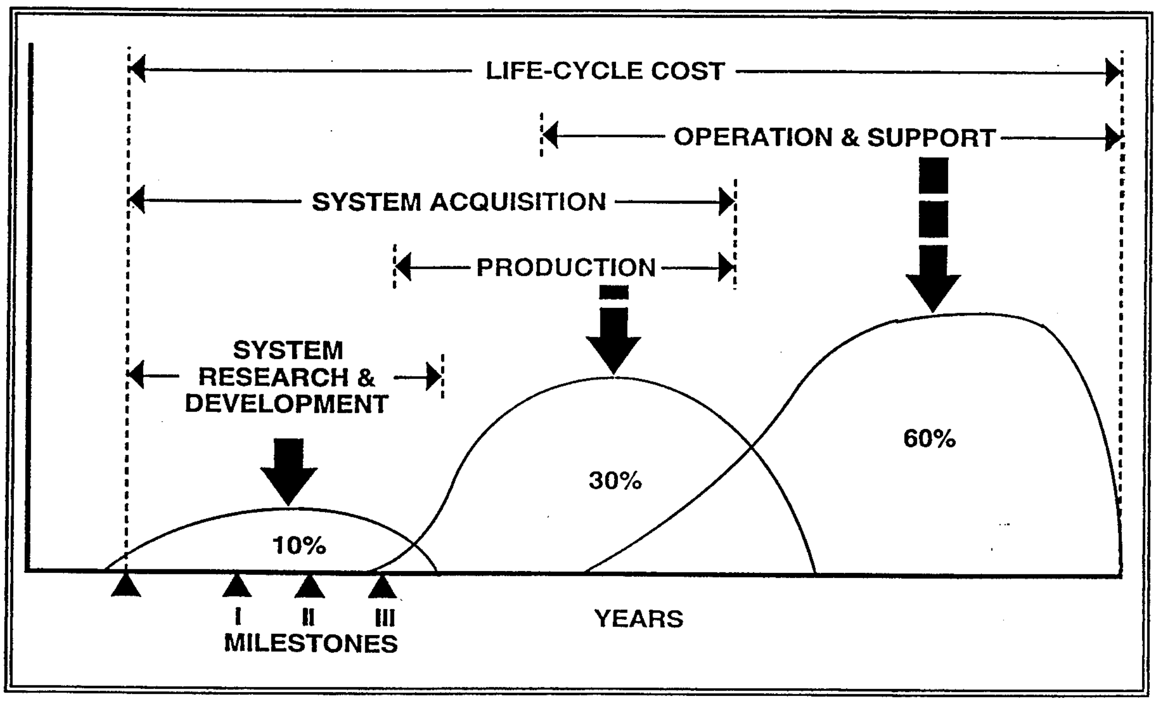

Figure 2.3. Typical Life-Cycle Cost Distribution From [Ref. 7]

LIFE-CYCLE COST DISTRIBUTION				
	TYPICAL	**F-16**	**BRADLEY**	**B-52**
R&D	10%	2%	2%	2%
Production	30%	20%	14%	21%
O&S	60%	78%	84%	77%

Table 2.1. Life-Cycle Cost Distributions From [Ref. 5]

alternative operational use profiles, maintenance and support policies, human-machine allocations, equipment packaging schemes, level of repair concepts and so on, have a great impact on total cost." [Ref. 6]

c. *ILS Defined*

In his book, "Logistics Engineering and Management" [Ref. 4], Benjamin S. Blanchard defines ILS as "a management function that provides the initial planning, funding, and controls which help to assure that the ultimate consumer (or user) will receive a system that will not only meet its performance requirements, but one that can be expeditiously and economically supported throughout its programmed lifecycle." He goes on to state that one of the primary objectives of ILS is the <u>integration</u> of the various elements of logistics.

Professor Paul McIlvaine, from the Logistics Support Department at the Defense Systems Management College (DSMC), claims that, in addition to the integration of the elements of logistics, there are two other areas that ILS must integrate into the total acquisition process. These areas are: (1) time; and (2) logistics related disciplines. (See Figure 2.4)

Integration among the elements of logistics include items such as:

- Maintenance Planning
- Computer Resources Support
- Facilities
- Supply Support
- Support and Test Equipment
- Packaging, Handling, Storage, and Transportation
- Manpower and Personnel
- Training and Training Systems
- Technical Data

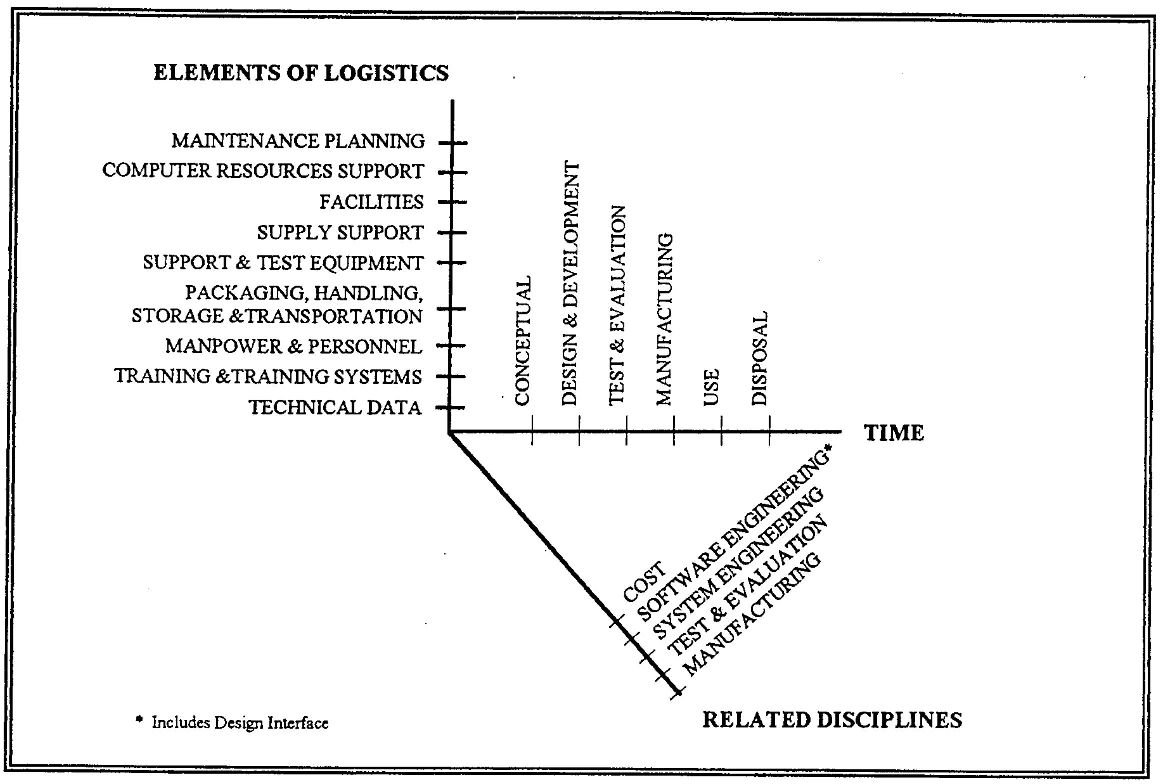

Figure 2.4. The Dimensions of Logistics From [Ref. 5]

Integration among logistics related disciplines include areas such as:

- Cost (both design to cost and life cycle cost)
- Systems Engineering
- Software Engineering
- Test and Evaluation
- Manufacturing Management

And integration with the specific time frames within the systems lifecycle include:

- Conceptual Phase
- Design and Development Phase
- Test and Evaluation Phase
- Manufacturing / Production / Construction Phase
- Use Phase
- Disposal / Recycling Phase

"Thus, 'Integrated' logistics support provides a three dimensional problem for the practitioner." [Ref. 5]

A more formal and precise definition of ILS is presented in DoDI 5000.2, Part 7A, "Integrated Logistics Support," [Ref. 8] as

> a disciplined, unified and iterative approach to the management and technical activities necessary to:
> 1. Develop support requirements that are related consistently to readiness objectives, to design, and to each other;
> 2. Integrate support considerations effectively into the system and equipment design;
> 3. Identify the most cost-effective approach to supporting the system when it is fielded; and
> 4. Ensure that the required support structure elements are developed and acquired.

It is this definition of ILS that the reader should associate with the word "ILS" throughout the remainder of this thesis.

2. The ILS Elements

DoD identifies ten elements which, when taken together, constitute the essential building blocks of ILS. DoDI 5000.2, Part 7A, Attachment 1, "Integrated Logistics Support Elements" [Ref. 8], states that the integrated logistics support effort will encompass the ten ILS elements and that each of the elements must be addressed for both hardware and software in both peacetime and wartime conditions."

DoDI 5000.2 [Ref. 8] defines the ten ILS elements as follows:

- <u>Maintenance Planning</u>: The process conducted to evolve and establish maintenance concepts and requirements for the lifetime of the system.

- <u>Supply Support</u>: All management actions, procedures and techniques used to determine requirements to acquire, catalog, receive, store, transfer, issue and dispose of secondary items. This includes provisioning for initial support as well as replenishment supply support.

- <u>Support Equipment</u>: All equipment, mobile or fixed, required to support the operation and maintenance of the system. Equipment includes associated multi use end items, ground-handling and maintenance equipment, tools, metrology and calibration equipment, test equipment and automatic test equipment. It includes the acquisition of logistics support for support and test equipment.

- <u>Technical Data</u>: Scientific or technical information recorded in any form or medium, such as manuals and drawings. (Computer programs and related software are not technical data; documentation of computer programs and related software are. Also excluded are financial data or other information related to contract administration.

- <u>Training and Training Support</u>: The processes, procedures, techniques, training devices and equipment used to train civilian, active duty and reserve military personnel to operate and support the system. It includes individual and crew training (both initial and continuation); new equipment

training; initial, formal, and on-the-job training; and logistics support planning for training equipment and training device acquisitions and installations.

- Computer Resources Support: The facilities, hardware, software, documentation, manpower and people needed to operate and support embedded computer systems.

- Facilities: The permanent, semi-permanent, or temporary real property assets required to support the system, including studies to define facilities or facility improvements, locations, space needs, utilities, environmental requirements, real estate requirement and equipment.

- Packaging, Handling, Storage, and Transportation (PHS&T): The resources, processes, procedures, design considerations and methods to ensure that all system, equipment, and support items are preserved, packaged, handled, and transported properly, taking into consideration environmental issues, equipment preservation requirements for short and long term storage and transportability.

- Design Interface: The relationship of logistics-related design parameters to readiness and support resource requirements. These logistics-related design parameters are expressed in operational terms rather than as inherent values, and specifically relate to system readiness objectives and support costs of the system.

Eight of these ten ILS elements focus on the logistics support resources that contribute to system operation and the attainment of readiness objectives in the system's operational role. The other two elements, Maintenance Planning and Design Interface, are directly related to the systems engineering management process. "During early development phases, the Design Interface develops the supportability influence starting at the system indenture levels. This dovetails with detailed Maintenance Planning and eventually results in a bottom-up identification of total logistics resource requirements." [Ref. 7]

3. The Integrated Logistics Support Management Team

As stated previously, the goal of the acquisition process is the concurrent fielding of a fully functional, cost-effective system, and all of the requisite items of support. The functional area of ILS makes its contributions to this goal through the work of the Integrated Logistics Support Management Team (ILSMT).

The ILSMT has many functions to perform in order to achieve the overall goal of the acquisition process. Those functions include:

- PLANNING the details of the ILS Program and their relationship with overall program management and ensuring coordination of logistics issues among all members of the government / contractor management teams. [Ref. 7]
- "IDENTIFYING the integrated logistic support requirements (relative to each element) for each proposed design alternative (while the alternative exists only on paper)." [Ref. 5]
- "ADVOCATING the selection of the most easily supported design alternative. This involves communicating the logistic support implications of each design alternative to the other members of the design team." [Ref. 5]
- ". . . INFLUENCING the emergence of this design toward cost-effective / supportable detailed design decisions." [Ref. 5]
- "REFINING the integrated logistic support requirements (relative to each element) to reflect the particulars of the emerging design. This involves ensuring that the logistic support requirements are defined to the same depth and at the same pace as the emerging design." [Ref. 5]
- ". . . TESTING AND EVALUATING the planned logistic support for the product / system during developmental / engineering tests and during all early field tests." [Ref. 5]
- ". . . ACQUIRING all necessary items of support. This involves ensuring that the system definition includes both the system / product / service and all requisite items of support for each logistic element." [Ref. 5]
- PRODUCING a quality product that conforms to the design through the reduction of variability in the manufacturing process. [Ref. 5]

* <u>PROVIDING</u> the system to the customers in the right place, at the right time, and in the right quantities completes the primary job of the ILSMT. This is done through the execution of a good integrated logistics support plan (ILSP) and / or a first rate fielding plan. [Ref. 5]

These functions represent the true job of the ILSMT as part of the overall program management team. It is important to note that the execution of a modification program after the system has already been produced requires each of the ILSMT functions to be repeated. Thus ILS, "in a world of rapidly changing technology, never really goes away." [Ref. 5]

4. ILS Planning

a. Integrated Logistics Support Plan (ILSP)

The ILSP is the principal logistics document for an acquisition program. It describes the overall ILS program and includes all ILS program requirements, tasks, and milestones for the current acquisition phase. It also projects ILS program planning for succeeding phases. The DSMC ILS Support Guide [Ref. 7] states that the purpose of the ILSP is to:

* Provide a complete plan for support of the deployed system;
* Provide details of the ILS program and its relationship with overall program management;
* Provide necessary information on ILS aspects necessary for sound decisions on further development / production of the basic system; and
* Provide the basis for preparation of ILS sections of the procurement package, e.g., Statement of Work (SOW), Specification, and Source Selection and Evaluation Criteria.

Once it is approved, the ILSP is the implementation plan for all activities participating in the acquisition of the system. It is important to note that the initial ILSP must be developed during the Concept Exploration and Definition Phase (CED) of the system

acquisition in order to facilitate planning by other government agencies and contractors during this, and follow-on phases.

The ILSP consists of three basic sections: (1) General; (2) Plans, Goals and Strategy; and (3) ILS Milestones. Department of the Army Pamphlet 700-55, "Instructions for Preparing the Integrated Logistics Support Plan" [Ref. 9], provides the following basic guidance for the preparation of the ILSP in Army programs.

(1) General. This section normally consists of four sections. An "Introduction" section provides general background information about the system being acquired. A "Material System Description" section describes the overall material system, the major and secondary items to be incorporated, and a description of all components of the complete system as it is planned. A "Program Management" section identifies the ILS manager, participating organizations, the ILSMT, the Logistics Support Analysis (LSA) review team, and the working relationships with other groups. And an "Applicable Documents" section identifies documents providing guidance, parameters, performance characteristics, and other criteria for functions and requirements described in the ILSP.

(2) Plans, Goals, and Strategy. This section normally consists of ten sections.

- Operational and Organizational Plan. This section describes the Operational and Organizational (O&O) Plan in terms of mission requirements, operational environment, and other LSA input parameters.

- System Readiness Objective. This section defines proposed System Readiness Objectives (SROs) and reliability, availability, and maintainability (RAM) for both peacetime and wartime situations.

- Acquisition Strategy. This section defines the contractual approaches and incentives for LCC, support risks, Manpower and Personnel Integration (MANPRINT) requirements, source selection, RAM, elements of support acquisition, transportability, and other data.

- LSA Strategy. (This section may be provided as a separate document because of its importance.) This section describes the LSA strategy to be used and identifies the LSA tasks and subtasks which will be used.

- Supportability Test and Evaluation Concepts. This section describes the planned supportability test and evaluation (T&E) concept, scope, and objectives, and how they will be met during T&E.

- ILS Element Plans. This section identifies the objectives, concepts, trade-off factors, goals, thresholds, special requirements, responsibilities, and validation and verification requirements for each ILS element. The manner in which the ILS elements are to be progressively specified, designed, tested and / or acquired and then integrated with the other elements will also be documented.

- Support Transition Planning. If contractor support is being considered, this section will describe how transition to Government support will be accomplished.

- Support Resource Funds. This section identifies the support resource funds involving ILS related life-cycle funding requirements, by ILS element, program function and appropriation category.

- Post Fielding Assessment. This section includes the plans for analyzing and assessing field data feedback related to material support and support system performance. The plans address assessment methodology, identify milestones and responsibilities, and describe the strategies for improvements.

- Post-Production Support. (This section may be provided as a separate document because of its importance.) This section documents the resources and management actions required to ensure the sustainment of SRO requirements and logistic support at all levels following the cessation of the production phase for a system.

(3) ILS Milestone Schedule. The ILS milestone schedule shows specific ILS and ILS related program tasks and events. The schedule includes the proposed beginning, current schedule, and completion dates of significant actions. The ILS milestone schedule also shows the inter-relationship of logistics tasks and events to the overall program milestones.

b. Integrated Support Plan

The Integrated Support Plan (ISP) sets forth the contractor's plan for accomplishing the projected ILS effort. Pertinent portions of the ISP are usually incorporated into updates of the government prepared ILSP. According to the DSMC ILS Support Guide [Ref. 7], the contents of the contractor's ISP include:

- Organization
- Responsibilities
- Schedules
- Major Tasks
- Sub-plans (e.g., LSA, training, provisioning)
- Inter-relationships among logistics elements
- External Constraints
- Other Pertinent Factors

c. Post-Production Support Plan

The Post-Production Support Plan (PPSP) is the plan that identifies the sustainment actions necessary to maintain the system in an effective operational state after the contractor delivers the last production system. The PPSP is a joint government / contractor effort. The DSMC ILS Support Guide [Ref. 7] states that the PPSP should focus on issues such as:

- System and subsystem readiness objectives in the post-production time frame;
- Organizational structures and responsibilities in the post-production time frame;
- Modifications to the ILSP to accommodate the needs of PPS planning;

- Resources and management actions required to meet PPS objectives;
- Assessment of the impact of technological change and obsolescence;
- Evaluation of alternative PPS strategies to accommodate production phase-out;
- Consideration of support if the life of the system is extended past the original forecast date;
- Data collection efforts in the early deployment phase to provide the feedback necessary to update logistics and support concepts;
- Potential for Foreign Military Sales (FMS) and its impact on the production run; and
- Provisions for the use, disposition and storage of government tools and contractor-developed factory test equipment, tools and dies.

d. Deployment Planning

The Deployment Plan outlines the schedules, procedures and actions necessary to successfully deploy a new material system. Planning for deployment begins with the initial development of the ILSP and intensifies as the system moves through the various phases of the acquisition life-cycle. Figure 2.5 shows the relationship between the deployment activities and the major ILS activities.

5. Logistics Support Analysis

DoDI 5000.2 defines Logistics Support Analysis (LSA) as "the selective application of scientific and engineering efforts undertaken during the acquisition process as part of the systems engineering process to assist in: causing support considerations to influence design; defining support requirements that are related optimally to design and to each other; acquiring the required support; and providing the required support during the operational phase at minimum cost." The objective of LSA is "to ensure that a systematic and comprehensive

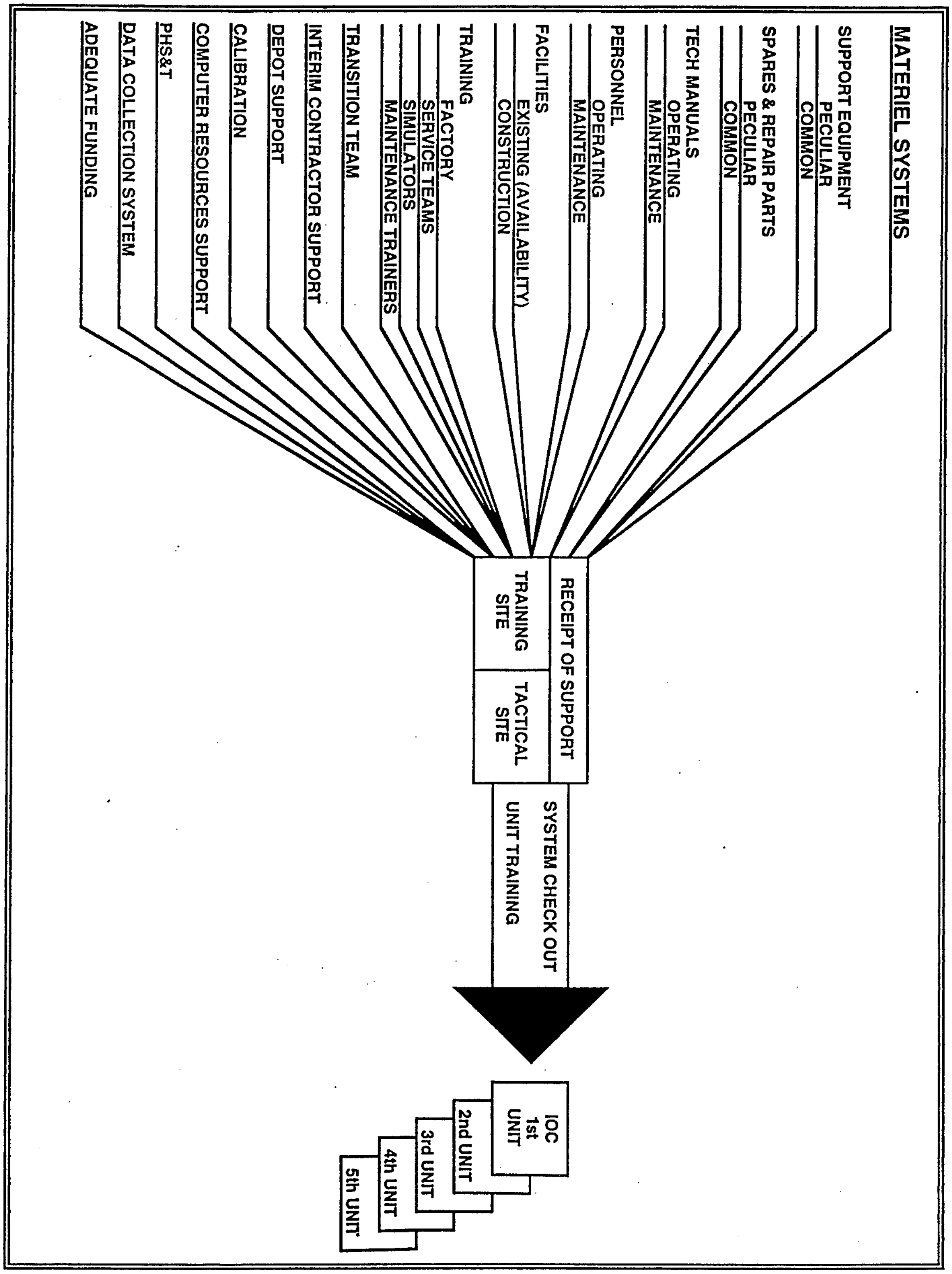

Figure 2.5. Deployment Requirements From [Ref. 7]

analysis is conducted on a repetitive basis through all phases of the system life cycle in order to satisfy readiness objectives at an affordable cost." [Ref. 7]

a. LSA Task Requirements

MIL-STD-1388-1A, "Logistics Support Analysis," [Ref. 10] is the controlling document for LSA and describes, in detail, the five general task sections, 15 tasks, and 77 subtasks that encompass the LSA effort. The general time phasing of the LSA tasks is shown in Figure 2.6. The DSMC ILS Support Guide [Ref. 7] summarizes the five general task sections as follows:

- Task Section 100: Program Planning and Control - The primary purpose of the tasks in this section is the management and control of the LSA program. The tasks provide for formal program planning and review actions.

- Task Section 200: Mission and Support System Definition - The tasks contained in this section identify the operational role and intended use of the new system and establish support resource constraints, readiness objectives, supportability design requirements and measures of logistics support. During the early phases of and acquisition program these analytical tasks provide the greatest opportunity for the government to influence the design of the system for support.

- Task Section 300: Preparation and Evaluation of Alternatives - The tasks contained in this section are highly iterative in nature and are applicable to successive phases of the preproduction part of the life cycle as well as to production design changes. The tasks are generally performed in sequence. Functions are identified, alternatives are developed to satisfy the functions, and evaluations and trade-offs are conducted. The process is then repeated at increasingly lower levels of the systems's Work Breakdown Structure (WBS) in the classic system engineering manner.

- Task Section 400: Determination of Logistics Support Resource Requirements - This portion of the LSA defines requirements for the ILS elements. Operational and maintenance tasks are analyzed to determine the support resources required. As development progresses, increasingly more specific design and operational data is used to identify logistics resource requirements to more detailed levels. This section includes an early assessment of the impact of the new system on operational forces and planning to provide continued support after the system is no longer in production.

- Task Section 500: Supportability Assessment - The supportability test and evaluation program serves three objectives throughout a program's life-cycle: (1) develop logistics test and evaluation requirements as inputs to system test and evaluation plans; (2) demonstrate contractual compliance with design requirements; and (3) identify supportability problems requiring corrective action.

LSA TASK SECTIONS AND TASKS	Pre-Concept	CED	DV	EMD	P&D/O&S	Design Changes
Task 100: PROGRAM PLANNING AND CONTROL						
Early LSA Strategy (101)	X	X	X			
LSA Plan (102)		X	X	X	X	X
Program & Design Reviews (103)		X	X	X	X	X
Task 200: MISSION AND SUPPORT SYSTEM DEFINITION						
Use Study (201)	X	X	X	X		
System Standardization (202)		X	X	X		X
Comparative Analysis (203)	X	X	X	X		
Technological Opportunities (204)		X	X			
Supportability Factors (205)		X	X	X		X
Task 300: PREPARATION AND EVALUATION OF ALTERNATIVES						
Functional Requirements Ident. (301)		X	X	X		X
Support System Alternatives (302)		X	X	X		
Evaluation of Alterations & Tradeoffs (303)		X	X	X		X
Task 400: DETERMINATION OF LOGISTIC SUPPORT RESOURCE REQUIREMENTS						
Task Analysis (401)			X	X		X
Early Fielding Analysis (402)				X		X
Post-Production Support (403)				X	X	X
Task 500: SUPPORTABILITY ASSESSMENT						
Supportability Assessment (Test, Evaluation and Verification) (501)			X	X	X	X

Figure 2.6. Acquisition Phase Timing of LSA Tasks From [Ref. 7]

b. LSA Tailoring

The key to an effective LSA program lies in the selective tailoring of LSA subtasks. The goal of this tailoring is to concentrate available resources on the areas that will most benefit the program.

The LSA effort can be tailored in several different ways. Figure 2.7 portrays a general tailoring logic tree which should be followed in selecting LSA tasks. MIL-STD-1388-1A [Ref. 10] states that the initial selection of tasks and subtasks can be adjusted for the following considerations:

- The amount of design freedom.
- Time phasing adjustments if program is "fast track."
- Work already done.
- Data availability and relevancy.
- Time and resource availability.
- Policy directive information needs.
- Desired tasks not in the standard.
- Procurement considerations.

After the initial selection of subtasks is completed, the effort is further focused by concentrating effort in high leverage areas.

6. ILS Summary

Figure 2.8 summarizes the relationships among ILS requirements, LSA tasks, the ILSP, and the acquisition life-cycle phases.

C. NONDEVELOPMENTAL ITEM ACQUISITION

1. History / Background

Nondevelopmental Item (NDI) acquisition has been part of the systems acquisition process for the past 25 years. In the past ten years, however, it has received greater emphasis. In June of 1986, the President's Blue Ribbon Commission on Defense Management (the

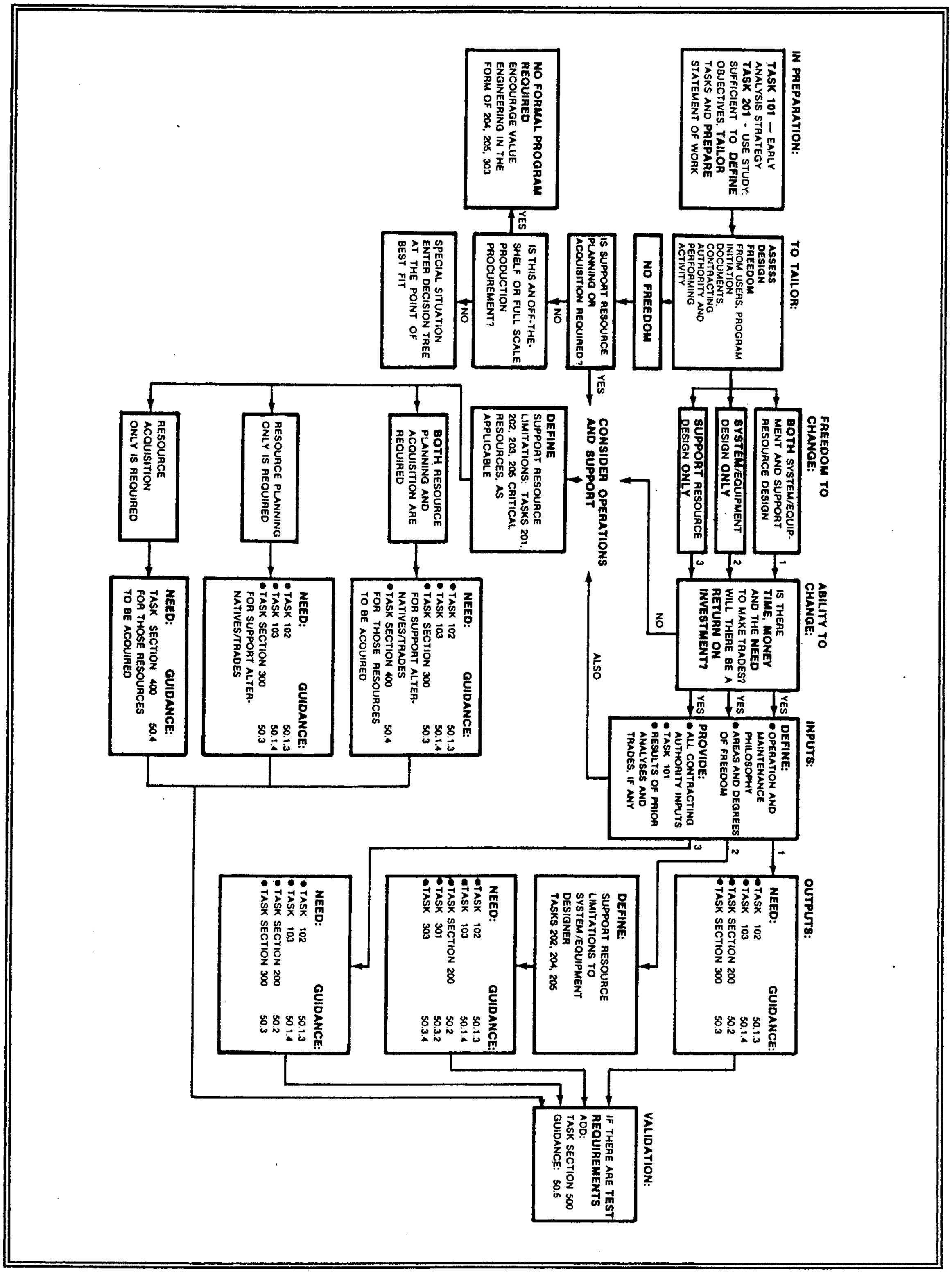

Figure 2.7. LSA Tailoring Decision Logic After [Ref. 10]

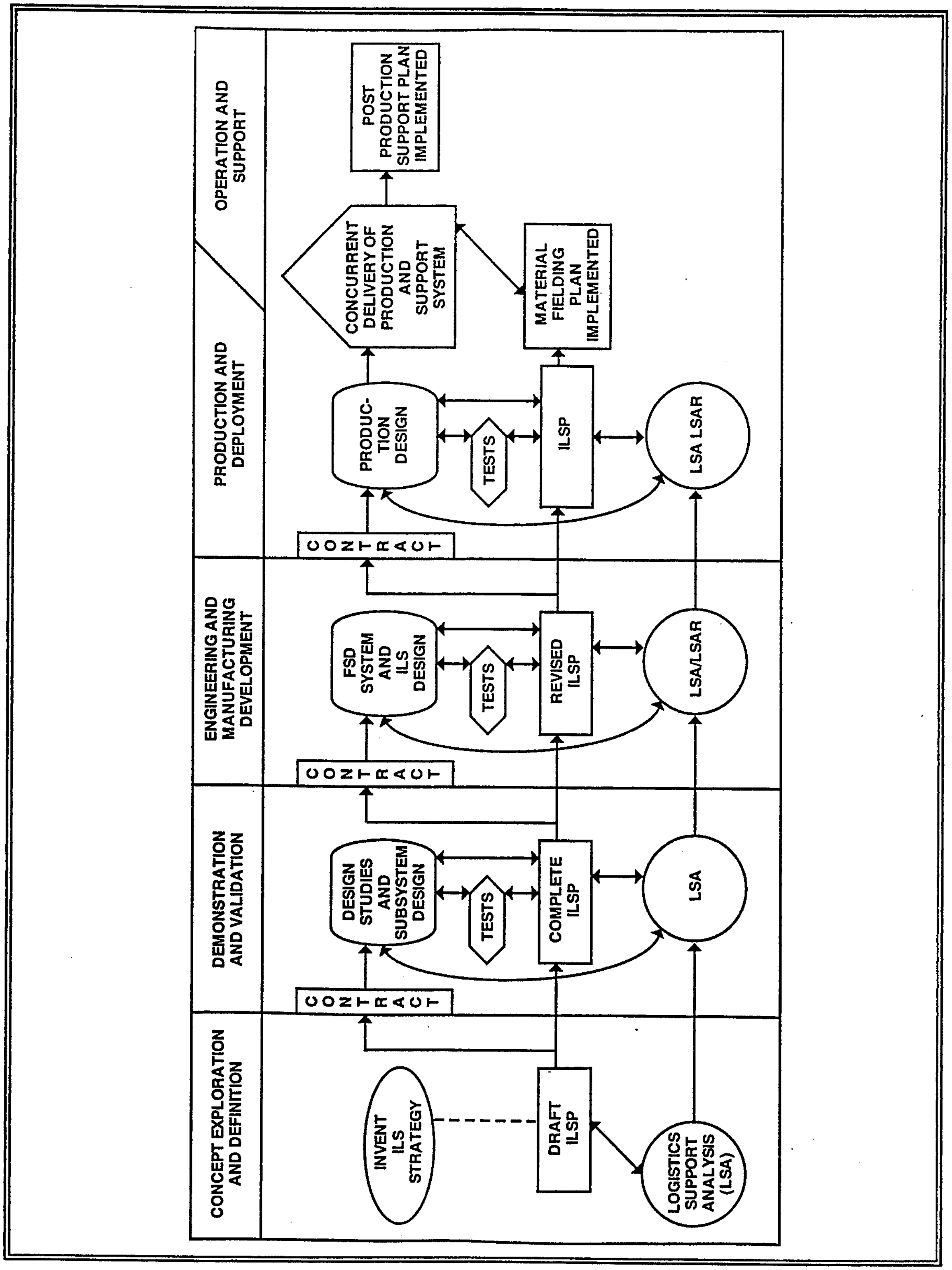

Figure 2.8. The Integrated Logistics Support Process From [Ref. 7]

Packard Commission) released its final report on defense acquisition. Among other things, this report emphasized a greater use of components, systems, and services available "off-the-shelf." The report also said that DoD should only develop new or custom made items when it has been clearly established that "readily available items" are unable to meet military requirements.

Following in the footsteps of the Packard Commission's findings, the NDI Preference Act of 1987 was passed. This Act required the DoD to state requirements in terms of functions to be performed, performance required, and essential physical characteristics. The Act also required that a preference for NDIs be established in defense acquisitions.

In June of 1989, the National Security Review 11 on Defense Management acknowledged the findings of previous studies and recommended actions to increase the use of NDIs in meeting DoD requirements. This was the final review prior to the revision of DoDD 5000.1, "Defense Acquisition" [Ref. 11] and DoDI 5000.2, "Defense Acquisition Management Policies and Procedures" [Ref. 8] in 1991.

In February of 1991, DoDD 5000.1 and DoDI 5000.2 were released with specific guidance on the use of NDIs in Defense acquisitions. DoDD 5000.1 requires DoD components to make "maximum practical use of off-the-shelf commercial products." In addition, DoDI 5000.2 states that material requirements shall be satisfied to the maximum extent practicable through the use of NDIs when such products will meet the user's need and are cost effective over the entire life cycle.

2. NDI Defined

In the fiscal year (FY) 1987 Defense Authorization Act, under the heading of "Preference for NDIs," Congress defined NDI as: (1) any item available in the commercial marketplace; (2) any previously developed item in use by the U.S. Government or cooperating foreign governments, or; (3) any item of supply needing only minor modifications to meet DoD requirements. This definition has been modified by each of the military services based on how they handle NDI acquisitions.

The Army breaks its definition of NDI down into three distinct categories: "(1) off-the -shelf or basic NDI -- used in the same environment for which items were designed and no development or modification is required; (2) NDI adaptation -- products needing adaptation for use in an environment different from that for which they were designed (hardening, strengthening and related modifications may be required); and (3) NDI integration -- integrating NDI components and subsystems (. . .the resulting product requires research and development (R&D) efforts; i.e., testing, systems engineering, etc., to ensure user needs are satisfied.)" [Ref. 4]

From the Army's definition of NDI, it is obvious that commercial off-the-shelf (COTS) items and NDIs are not synonymous. COTS items are just one category of what DOD and the Army call NDIs.

3. Benefits and Challenges of NDI Acquisitions

NDI acquisitions provide several benefits and challenges to the systems acquisition process and user. The four primary benefits of NDI acquisitions are:

- Quick response to operational needs
- Elimination or reduction of R&D costs
- Application of state-of-the-art technology to current requirements
- Reduction of technical, cost, and schedule risks [Ref. 12]

The primary challenge to NDI acquisitions is the possibility of items developed for other than DOD needs not meeting all user requirements. When this occurs, mission performance trade-offs may be required to gain the advantages of pursuing NDI alternatives. Decisions governing operational requirements trade-offs require user review and approval. Additional challenges to NDI acquisitions include: providing logistics support; product modifications; and, continued product availability.

4. The Application of NDI to an Acquisition

The application of NDI to an acquisition cannot be viewed as an all or nothing proposition. Rather, it must be viewed as a spectrum of NDI involvement ranging from complete involvement to no involvement. Figure 2.9 illustrates this point. In general, as the extent to which NDI is used in an acquisition moves from no involvement (Full Development) to complete involvement (COTS), the development costs and development time go down.

As can be seen in Figure 2.9, a predominant use of NDI is related to the insertion of NDI at the subsystem, component, and piece part levels. The opportunity for NDI involvement in the system should be explored as part of the system engineering and system integration processes.

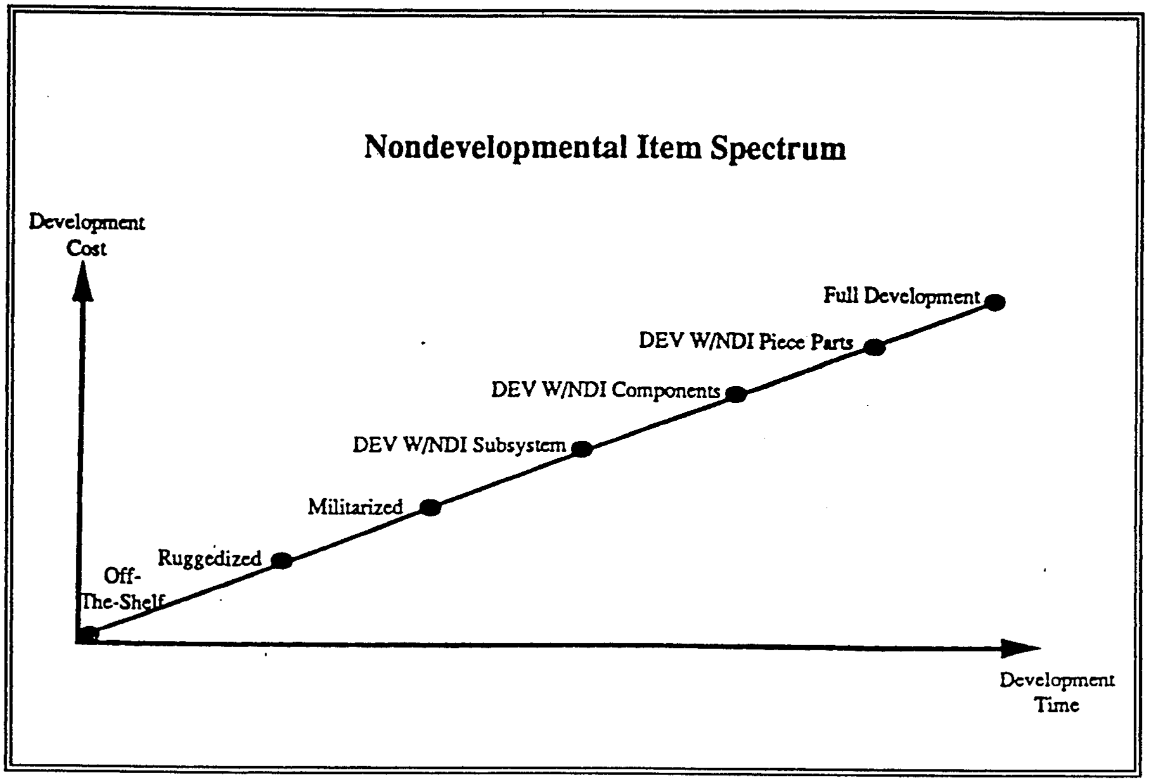

Figure 2.9. Nondevelopmental Item Spectrum From [Ref. 12]

5. Basic Concepts in NDI Acquisitions

The most fundamental NDI concept is that the system must meet the user's requirements and function in the user's environment. Furthermore, an NDI solution must represent the most cost effective way of meeting the user's requirements. In other words, to be a viable option, an NDI solution must meet the user's requirements, and perform at a lower LCC than a developmental alternative.

Another important concept in NDI acquisitions is flexibility in determining operational requirements. Flexibility should be pursued by both the user and the developer through communication and coordination. The developer must be responsive to legitimate needs but be conscious of technical risks and affordability constraints. The user must be realistic in

stating needs and considering trade-offs. The user must determine whether trade-offs between proven capability and rapid deployment out weigh possible performance limitations. If performance trade-offs are made, they must be formally changed in operational requirements documents. [Ref. 12]

The final basic concept of NDI deals with tailoring the systems acquisition process to the current acquisition. NDI acquisitions are managed within the overall system acquisition process used for developmental items. With NDI, however, some of the steps, procedures, and requirements associated with the acquisition process may not be necessary. It is imperative that the standard process elements be analyzed to determine their applicability to the NDI acquisition at hand. This tailoring of the process is essential in gaining the time and money saving benefits of an NDI acquisition.

6. NDI Summary

The ultimate goal for NDI acquisitions is the same as for all DOD acquisitions; that is, to provide reliable, supportable systems to the operational force in a timely manner and at a reasonable cost. NDI acquisitions can achieve this goal with the potential advantage of reducing time and cost. Additionally, Congress has legislated the increased use of NDIs in all acquisition programs. The effective evaluation and application of a viable NDI solution can maximize the return to the user, the developing agency, and the taxpayer.

D. ILS IN NDI

1. ILS Challenges in NDI Acquisitions

Effective ILS planning and implementation pose a challenge in developmental programs, even with all of the training and guidance that acquisition personnel receive.

Ensuring that ILS is handled effectively in NDI acquisitions can be a significantly more difficult challenge to acquisition personnel because of the differences in the NDI acquisition process. First and foremost among those differences is the compressed acquisition life cycle.

The compressed acquisition life cycle effectively reduces the amount of time available for planing and developing organic logistics support. ILS activities that normally take place during the demonstration and validation (DEMVAL) and the engineering and manufacturing development (EMD) phases of the life cycle must be accelerated to ensure that effective support is developed or procured for the system. Additionally, logistics support may be adversely impacted by rapidly evolving NDI hardware and software since DoD may not be acquiring sufficient technical data and technical-data rights to maintain configuration control of commercial items. [Ref. 4]

Acquisition personnel must be sensitive to these, and other, challenges and ensure that they are addressed early in the acquisition process. They must understand that implementing effective ILS for NDIs will probably require a departure from the "normal" procedures of a developmental item acquisition.

2. ILS Considerations in NDI Acquisition

a. Market Analysis

In determining the validity of an NDI acquisition, the system or components under consideration must be assessed on the basis of performance and life-cycle cost effectiveness. This assessment is called market analysis. The effective implementation of NDI acquisitions is dependant upon a thorough market analysis. It requires the developing agency

and the user to investigate potential viable sources to meet the user's requirements at a "more reasonable" price, even if performance trade-offs are required.

It is during the market analysis for a given program that the developing agency must provide logistics support information to industry. This information should include items such as: planned maintenance echelons; maintainer proficiency levels; software maintenance plans; limitations on evacuation of reparables; maintenance environment; supply support; training needs; and, technical data needs. [Ref. 4]

In its response to this Government information, industry should respond with information on: system or component reliability history; maintainability features; flexibility for government maintenance; critical interfaces with other sub-systems affecting supportability; maintenance in various environments / conditions; extent of competition for support; warranties; current military and commercial customers; estimated life-cycle costs; and, requirements / source of logistics related training. [Ref. 4] It is this information that allows the developing agency to form an initial estimate of a system or components ability to meet the user's requirements in terms of ILS.

b. Formulating the ILSP

Based on the logistics support knowledge gained during the market analysis, a tailored ILSP must be prepared to provide a complete plan for the ILS of the system. Thoroughness in preparation of the ILSP is critical in an NDI acquisition because of the compressed time schedule. In a survey conducted by the DSMC 1991-92 Military Research Fellows [Ref. 4], one respondent said:

> It takes me 18 - 20 months to do a user and market survey and put on contract a piece of commercial equipment. From contract award, the vendor can

usually deliver equipment within 3 - 6 months; it takes nearly 30 months to do all the logistics required for fielding. Logistics is, by far, the 'long pole in the tent.' TMs (Technical Manuals) and MAC (Maintenance Allocation Charts) are the longest, along with parts provisioning and stocking."

Decisions on how the NDI will be supported must be considered during trade-off analysis. It is important to realize that there may not be an "ideal" solution to ILS in an NDI acquisition. As long as all legitimate concerns are recognized, and the ILSP is structured to optimize the risk that they present, effective ILS can be achieve for the life of the NDI. [Ref. 4]

c. Contractor vs Organic Support

One of the primary areas of concern while developing the ILSP for an NDI is to what extent contractors will be involved in the support of the system after it is deployed. Due to the shortened development times associated with NDI acquisitions, there may be little or no time to establish an organic support capability initially. Interim contractor support during initial deployment is one method that the developing agency can deal with this shortfall. It allows a system to be deployed and operational while organic support capability is being established.

Figure 2.10 can be used as a guide in developing a logistics support strategy. It is important to note, however, that a decision to rely on lifecycle contractor support (LCCS) must be agreed upon by users and supporting activities and it must be accompanied by adequate planning. [Ref. 12]

The Office of the Assistant Secretary of Defense publication SD-2, "Buying NDI," [Ref. 12] provides the following narrative explanation of Figure 2.10.

There are five use factors: How the NDI will be used from "as is" to fully militarized modification; where the NDI will be used, i.e., in what environment, form a fixed / industrial / nonhostile one to a mobile / austere / hostile one; how long the NDI system will be used, i.e., the system's projected service life; when the NDI is to be used, i.e., to be deployed immediately or sometime in the future; and, why an NDI is being selected, to take advantage of an advancing technology (with changing configurations) or the availability of a proven, stable design. Each use factor shows a range of support methods.

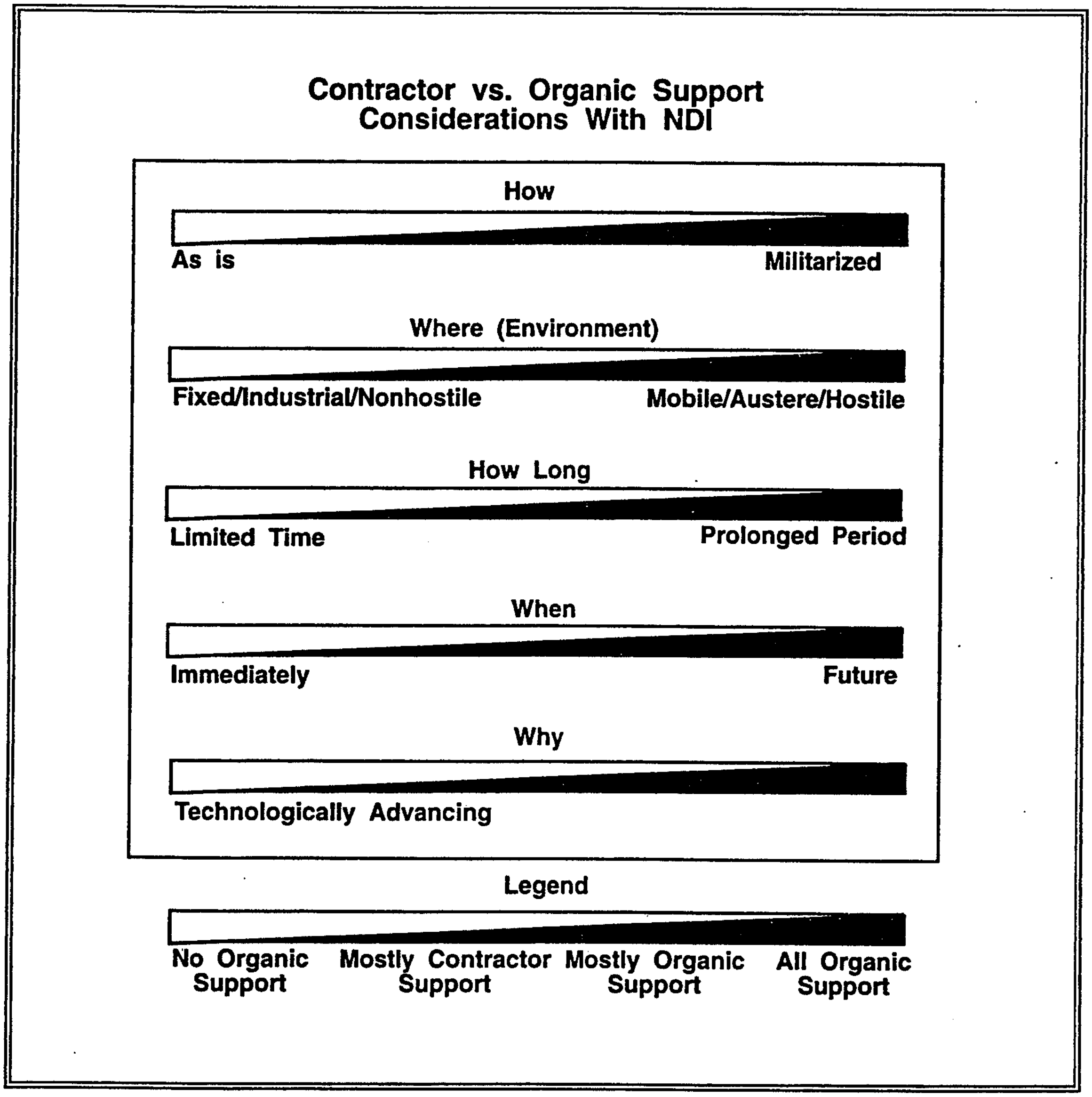

Figure 2.10. Contractor vs Organic Support From [Ref. 12]

These methods range from no support, which implies disposal upon failure to full organic support, and includes full contractor support and combined contractor / organic support. The proposed NDI and its system use factors may serve as a guide in planning the logistic support strategy.

d. LSA Tailoring

As mentioned before, the key to an effective LSA program lies in the selective tailoring of LSA subtasks. The goal of this tailoring is to concentrate available resources on the areas that will most benefit the program. This is especially important in NDI acquisitions. Figure 2.11 and 2.12 contain examples of how to tailor LSA requirements to NDI acquisitions.

e. Configuration Management and Control

Configuration management and configuration control must be carefully evaluated when considering NDI alternatives. The ability of the user to adjust to possible configuration changes which are beyond their control is an important consideration for NDI acquisitions since other buyers, commercial or military, may drive changes to an item which affect the user's ability to support the item. This real possibility requires careful consideration when conducting trade-off decisions. [Ref. 12]

Furthermore, the developing agency is often relegated to limited configuration control with NDIs due to the commercial or multiple use nature of such items. This limited configuration control should influence the technical data requirements that the developing agency places on the contractor. For example, with limited configuration control, form, fit, and function data is preferred to full design engineering data since the latter is more expensive and is prone to obsolescence. [Ref. 12]

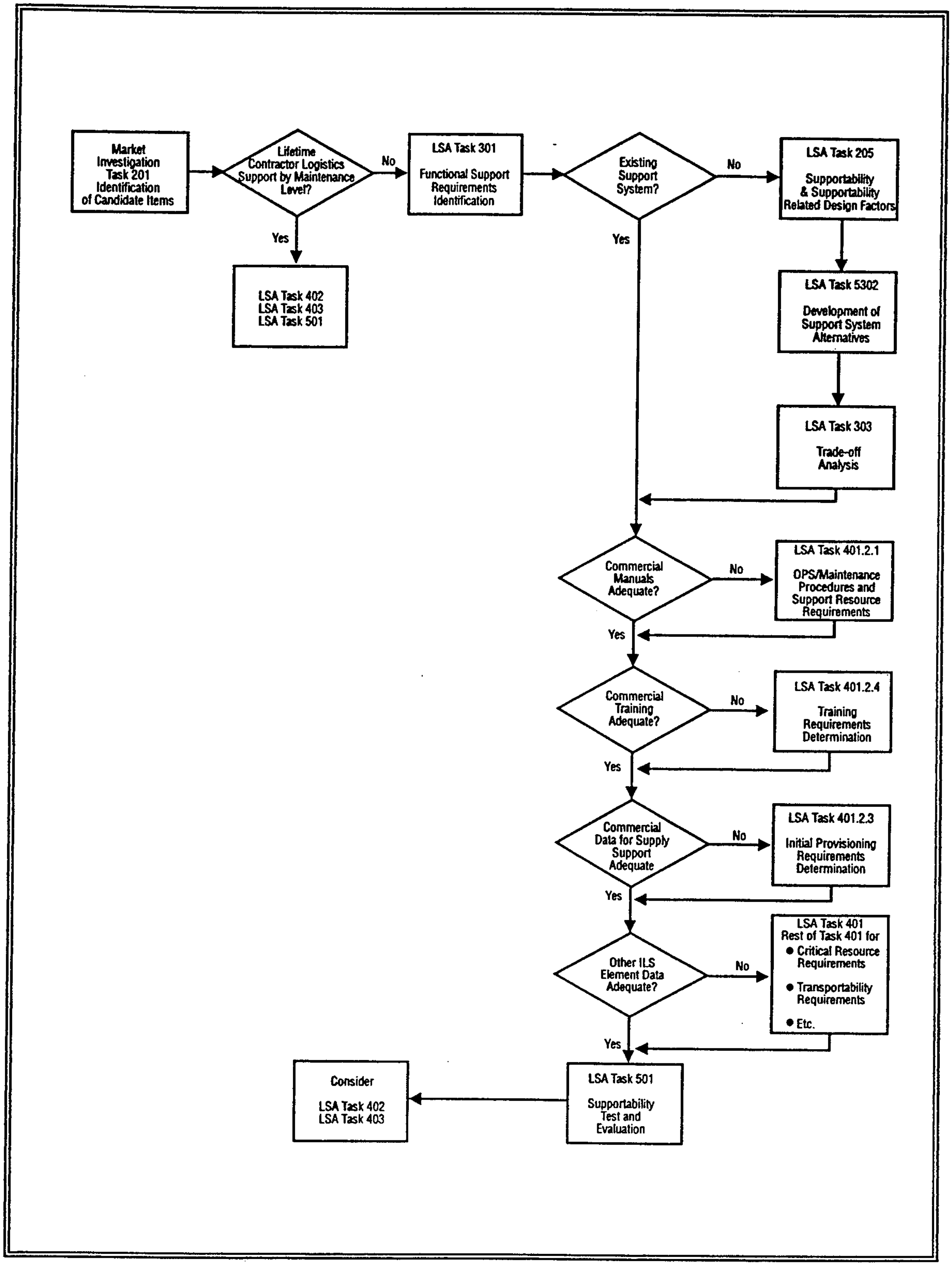

Figure 2.11. NDI LSA Tailoring (Air Force Version) From [Ref. 4]

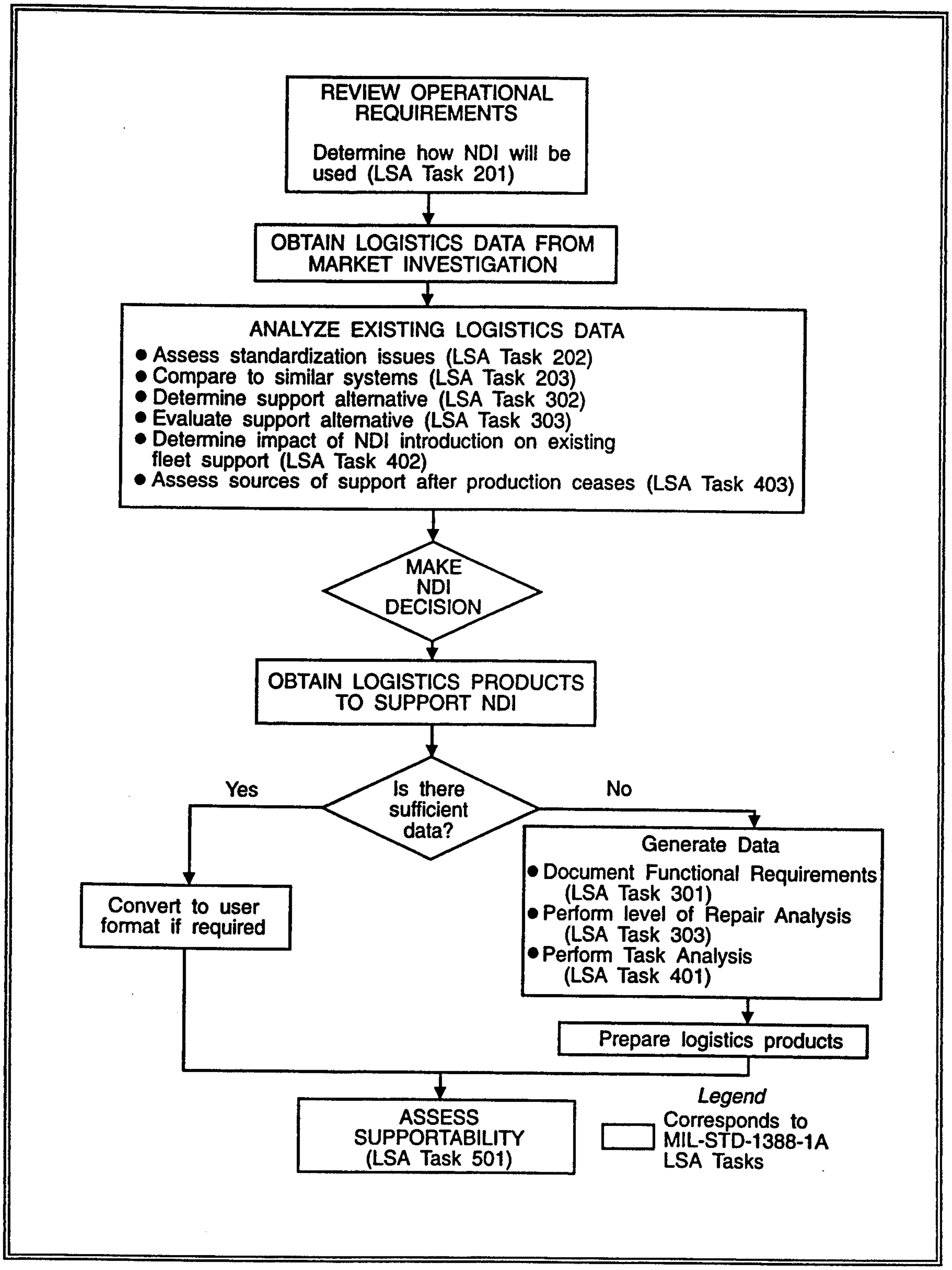

Figure 2.12. NDI LSA Tailoring (Navy Version) From [Ref. 4]

3. NDI Considerations for the Ten ILS Elements

a. Maintenance Planning

The primary challenge with respect to maintenance planning for NDI acquisitions is how, or to what extent, to use existing commercial or other maintenance and support systems. SD-2 [Ref. 12] lists the following items as factors that will influence the decision:

- The degree to which manufacturers, other military services, or other sources already provide maintenance support to existing customers;
- Responsiveness of such support activity to meet military requirements in peacetime and wartime (mean logistic down time, need for priority service, wartime surge, etc.);
- The degree to which the Service will be able to provide organic maintenance support, and the need for support facilities or a training and rotational base for service technical personnel; and,
- A need to minimize "down time."

NDI acquisitions give the developing agency the potential of using existing commercial or other service maintenance facilities to replace or supplement existing organic maintenance facilities. This effectively reduces life-cycle costs, personnel, training, and documentation requirements.

The developing agency and the user may determine that LCCS is the preferable method of support for the NDI system. If the contractor is willing and able to support their product with preventive maintenance, repair parts, and technical personnel through the item's expected service life, an acceptable support strategy must be selected. SD-2 [Ref. 12] lists the following as possible support strategies under the LCCS scenario:

- Return to factory for repairs
- Provision test equipment, procedures and parts for intermediate or depot-level repair
- Provision test equipment, procedures, and parts for user repair
- On-site repair by contractor personnel
- A combination of the above

b. Manpower and Personnel

The ILS element of Manpower and Personnel is concerned with the number and skill levels of people required to operate and maintain and item. SD-2 [Ref. 12] provides the following specific areas that influence NDI Manpower and Personnel decisions:

- Number and type of people required for operation
- Number and type of people required for maintenance
- New skills, knowledge or grades required

NDIs limit Manpower and Personnel activities because the acquisition is for a defined end-product. This means that, with limited exception, the design cannot be influenced to account for Manpower and Personnel constraints.

If the acquisition is for a COTS item, Manpower and Personnel analysis must determine whether the item, in its "off-the-shelf" configuration, meets Manpower and Personnel criteria for the requirement. If it does not, this will lead to a reevaluation of the basic NDI decision and / or modification of the initial support concept. If the acquisition is for a modified NDI, then negative findings during the Manpower and Personnel analysis may be compensated for by simple design modifications. [Ref. 12]

A thorough Manpower and Personnel analysis is absolutely critical during NDI acquisitions. "The results of . . . the analysis could dictate modification of commercial equipment, affect source selection, drive contractor logistics support, or eliminate NDI as a solution." [Ref. 12]

c. Supply Support

NDI acquisitions may provide the developing agency with a well established pool of usage data from the manufacturer and other users. This data can aid in the accurate prediction of initial provisioning requirements for repair parts and related support equipment as well as in estimating follow-on provisioning needs. However, the unique characteristics of NDI acquisitions add two areas of concern in Supply Support.

First, many commercial items are manufactured using a modular construction technique. This technique inherently requires unique repair parts. SD-2 [Ref. 12] states that where this impact is "great," alternative supply methods should be investigated and employed where cost-effective.

Second, is the concern over limited configuration control. The question here is how to provide supply support for items which may change from one procurement to the next. This obviously has a detrimental affect on the logistics system. Theoretically, each time a new or different item is brought into the inventory, new manuals, drawings and parts will have to be procured, while simultaneously supporting the existing equipment.

Both of these concerns must be thoroughly analyzed during the Supply Support analysis. Findings must be addressed in the ILSP.

d. Support Equipment

Support equipment requirements must be identified as early as possible. Normally, military standard test equipment is preferred to new or unique equipment. This may not be feasible with NDIs however. Regardless of the type of support equipment utilized, calibration standards and procedures will also need to be reviewed for the equipment.

e. Technical Data

ILS related technical data includes items such as specifications, drawings, technical manuals, calibration procedures and other data required to manufacture, test, inspect, perform preventive and corrective maintenance, operate, and repair the item or its parts. As with any type of acquisition, the technical data must complement the maintenance and supply support plans. What is imperative in NDI acquisitions is that problems concerning availability, maintenance, storage, and distribution must be resolved before the actual acquisition of the item in order to identify what technical data is actually needed for successful support of the program.

f. Training and Training Support

Operator and maintenance training requirements for NDI systems must be determined on an expedited basis. Additionally, contractor assistance may be required for initial new equipment training (NET) and establishment of the institutional training base. These requirements are determined by the developing agency in close coordination with the user.

g. Computer Resources Support

This ILS element includes the facilities, hardware, software, documentation, manpower, and personnel need to operate and support embedded computer systems. SD-2 [Ref. 12] states that the computer resources area is "NDI intensive." "Careful front-end investigation of all support, mission, interoperability, and market issues, while complying with applicable computer resource policies, will ensure an appropriate NDI acquisition." [Ref. 12]

h. Facilities

Facility requirement evaluation is important for NDI systems as well as developmental systems. However, two factors in NDI systems increase the demands for facility planning. These are (1) a compressed schedule; and (2) a non-DOD design. "It is important that early logistics considerations include defining the types of facilities, facility improvements, locations, space, and environmental requirements necessary to support the NDI." [Ref. 12]

i. Packaging, Handling, Storage, and Transportation

Requirements for packaging, handling, storage, and transportation of an item must be included in the solicitation. Commercial standards can be used to the extent that they satisfy military requirements. However, if any modifications are required, they must be identified early and included in the solicitation. The key here is to avoid the high cost of postproduction modifications.

j. Design Interface

"During all life-cycle phases and as part of the Market Analysis, the design characteristics are evaluated in terms of supportability issues, costs, and compatibility with

support equipment. These characteristics are included in source selection criteria, thus serving the intent of design influence and interface." [Ref. 12]

E. CHAPTER SUMMARY

One of the toughest challenges in the acquisition process is ensuring effective ILS. This challenge is especially prevalent in NDI acquisitions. This chapter provided a brief overview of the ILS process in defense system acquisitions and the basic concepts behind NDI acquisitions. It also took the integration of these two topics and looked at some of the challenges and considerations of ILS in NDI programs.

Some of those challenges and considerations facing the developing agency in the development of an effective NDI ILS plan are: the compressed acquisition life-cycle; the rapidly evolving nature of NDI hardware and software; the inability of the developing agency to influence the system design; and the debate over contractor versus organic support.

This all boils down to one thing: there may not be an "ideal" or "text book" solution to support for NDIs. Acquisition personnel must understand that implementing effective ILS for NDI will probably require a departure from the "normal" procedures of a developmental item acquisition. As long as the unique requirements and concerns of each NDI program are recognized and considered, effective ILS can be achieved for the life of an NDI.

III. CASE DESCRIPTION: INTEGRATED LOGISTICS SUPPORT IN THE SPECIAL OPERATIONS AIRCRAFT PROGRAM

A. INTRODUCTION

The Special Operations Aircraft (SOA) Program was initiated by Headquarters, Department of the Army (DA) message, DAMO-WSA, 301345Z April 1986, in response to the Department of Defense (DoD) Special Operations Forces (SOF) Airlift Report and the SOF Expedited Essential Required Operational Capability (ROC). [Ref. 19] In accordance with Army Regulation (AR) 70-1, "Army Acquisition Policy" [Ref. 2], the SOA Program was designated an Acquisition Category (ACAT) II, Type III Non-Developmental Item (NDI) Program. [Ref. 13]

In July 1987 the Product Manager (PM) for SOA was officially designated a Product Management Office (PMO) under the Program Executive Office (PEO) Aviation. The mission of the PMO was to "contract, develop and qualify" modifications to the UH-60L (Blackhawk) and the CH-47D (Chinook) to meet the ROC of the MH-60K and MH-47E. These aircraft are unique in comparison to the standard Army aircraft fleet. They include advanced systems such as: air-to-air refuel probes; larger fuel tanks; integrated avionics subsystems (IAS); multi-mode radar (MMR); upgraded engines; aircraft survivability equipment (ASE); forward-looking infrared (FLIR); and integrated mission, communication, and navigation systems.

This chapter is comprised of two main sections. The first major section describes the peculiarities of the MH-60K and MH-47E. It includes a brief overview of the mission need,

the operational requirement, and a detailed description of the system(s). The second major section describes the Integrated Logistics Support Plan (ILSP) for these unique aircraft.

The purpose of this chapter is twofold. First, it provides the reader with an understanding of the complexity of the systems involved in the SOA Program and the environment in which they must operate. And secondly, it provides the reader with an understanding of the depth and thoroughness of the ILS planning in the SOA Program. This chapter sets the ground work for an analysis of the adequacy of the ILS planning conducted for these complex aircraft.

B. THE SPECIAL OPERATIONS AIRCRAFT

1. The Mission

The SOA Program provided 23 MH-60K and 26 MH-47E helicopters to the United States Special Operations Command (USSOCOM). The aircraft are assigned to the Army's 160th Special Operations Aviation Regiment (SOAR) (Airborne)(A) in support of their special operations aviation mission.

The primary mission of the 160th SOAR(A) is the long range insertion, extraction, and resupply of Army, Navy, and Air Force SOF personnel and equipment. These SOF personnel are used in counter-terrorism actions, strategic intelligence strikes, tactical reconnaissance, infiltration, resupply, and night and day interdiction operations during periods of adverse weather and/or limited visibility conditions. Other missions include light-infantry operations in support of special operations, contingencies, and civil affairs and psychological operations. [Ref. 14]

2. The Mission Need

The SOA program was initiated to fulfill the operational requirement of a "US Army aircraft. . . capable of performing clandestine, deep penetration airlift missions in adverse weather with limited lighting and visibility during night or day conditions over all types of terrain." This validated requirement was based on the perceived limited ability of the UH-60L and CH-47D helicopters to perform special operations missions. The limitations of these aircraft were grouped into three broad categories: (1) performance characteristics; (2) vulnerability to threat weapon systems; and (3) limited self-deployability. [Ref. 1]

3. The Required Operational Capability

The required operational capability of the SOA was split into two requirements. One for a multi-mission utility helicopter, the MH-60K, and one for a multi-mission medium lift helicopter, the MH-47E.

a. MH-60K Operational Requirements

The requirements for a multi-mission utility helicopter were defined in the SOF Operational Requirements Document (ORD). The ORD required the aircraft to have an unrefueled mission radius of 200 nautical miles (NM) while carrying a four man flight crew, mission equipment package, ASE, suppressive weapons, and combat troops. At the midpoint of the mission, the aircraft must be able to hover Out-Of-Ground-Effect (OGE) at 2000 feet mean sea level (MSL), at 70 degrees Fahrenheit (F) while carrying 12 fully equipped personnel. (See Table 3.1.) [Ref. 15]

MH-60K REQUIRED OPERATIONAL CAPABILITY	
Operational Characteristics	**Requirement**
Combat Mission Radius	200 NM
Payload at 2000 ft / 70 degrees F, midpoint hover	12 passengers
Payload at 4000 ft / 95 degrees F, midpoint hover	7 passengers
Unrefueled self-deploy range	755 NM
Air-to-Air refueling	Yes
Night Vision Goggle compatibility	Yes
Shipboard operations compatibility	Yes
Secure, jam resistant communications	Yes
Navigation Accuracy	GPS equivalent

Table 3.1. MH-60K Required Operational Capability From [Ref. 15]

b. MH-47E Operational Requirements

The requirements for a multimission medium lift helicopter were defined in the SOF Operational Requirements Document (ORD). The ORD required the aircraft to have an unrefueled mission radius of 300 NM while carrying a four man flight crew, mission equipment package, ASE, suppressive weapons, and combat troops. At the midpoint of the mission, the aircraft must be able to hover OGE at 2000 feet MSL, at 70 degrees F while carrying 36 fully equipped personnel. (See Table 3.2) [Ref. 14]

4. The Mission Equipment Package

In order to overcome the limitations in operational capability that define the "mission need", the SOA Program began the design, integration, modification and qualification of a Mission Equipment Package (MEP) to enhance the operational capability of the UH-60L and CH-47D. The MEP included (1) an Integrated Avionics Subsystem (IAS) to enhance the

MH-47E REQUIRED OPERATIONAL CAPABILITY	
Operational Characteristics	**Requirement**
Combat Mission Radius	300 NM
Payload at 2000 ft / 70 degrees F, midpoint hover	36 passengers
Payload at 4000 ft / 95 degrees F, midpoint hover	30 passengers
Unrefueled self-deploy range	1260 NM
Air-to-Air refueling	Yes
Night Vision Goggle compatibility	Yes
Shipboard operations compatibility	Yes
Secure, jam resistant communications	Yes
Navigation Accuracy	GPS equivalent

Table 3.2. MH-47E Required Operational Capability From [Ref. 14)

communications and navigation capability of the aircraft; (2) an improved Aircraft Survivability Equipment suite; (3) more powerful armament; (4) the addition of external and internal fuel tanks and air-to-air refueling provisions; (5) upgraded transmissions (MH-60K only); and (6) upgraded engines (MH-47E only). The following paragraphs provide a brief description of the myriad of complex systems that were integrated into the aircraft as part of the MEP in order to bring the capability of the UH-60L and CH-47D up to the stated operational requirements.

a. Integrated Avionics System (IAS)

By far the most complex system and the most challenging to integrate into the aircraft was the IAS. The IAS is the heart and soul of the SOA and is the system that most differentiates the MH-60K and MH-47E from their brethren the UH-60L and CH-47D. The

following components and systems comprise the IAS. (See Figure 3.1 and Appendix B for system interfaces.)

(1) Cockpit Management System (CMS). The CMS is the primary interface between the flight crew, aircraft systems, and the IAS subsystems. It provides control and display of flight data and systems operation for communication, identification, navigation, flight direction and guidance, mission aids, and ASE. The system also provides control and display of aircraft systems, component status, self-test capability, caution, warning, and advisory alerts, and zeroizing of mission data. [Ref. 16]

The CMS is a redundant system which incorporates traditional flight instruments and system indicators into an electronic ("glass") cockpit. System performance is displayed on a by exception basis. Dual components and data buses ensure that system operation will not be compromised by a single failure. The CMS is comprised of the following components. [Ref. 16]

Four Multifunction Displays (MFD), two in each pilot instrument panel, provide display of flight symbology data, sensor video, communications / navigation, aircraft system status, etc. (See Figure 3.1) [Ref. 16]

Two Control Display Units (CDU), one on each side of the center console, provide the primary data input source for the CMS and replace conventional control panels for systems management. (See Figure 3.2) [Ref. 16]

Two fully redundant Mission Processors (MP), located in the avionics compartment, control all CMS functions. [Ref. 16]

Two Remote Terminal Units (RTU), located in the avionics compartment, provide the interface between the 1553B data buses and those components which are not 1553B data bus-compatible. [Ref. 16]

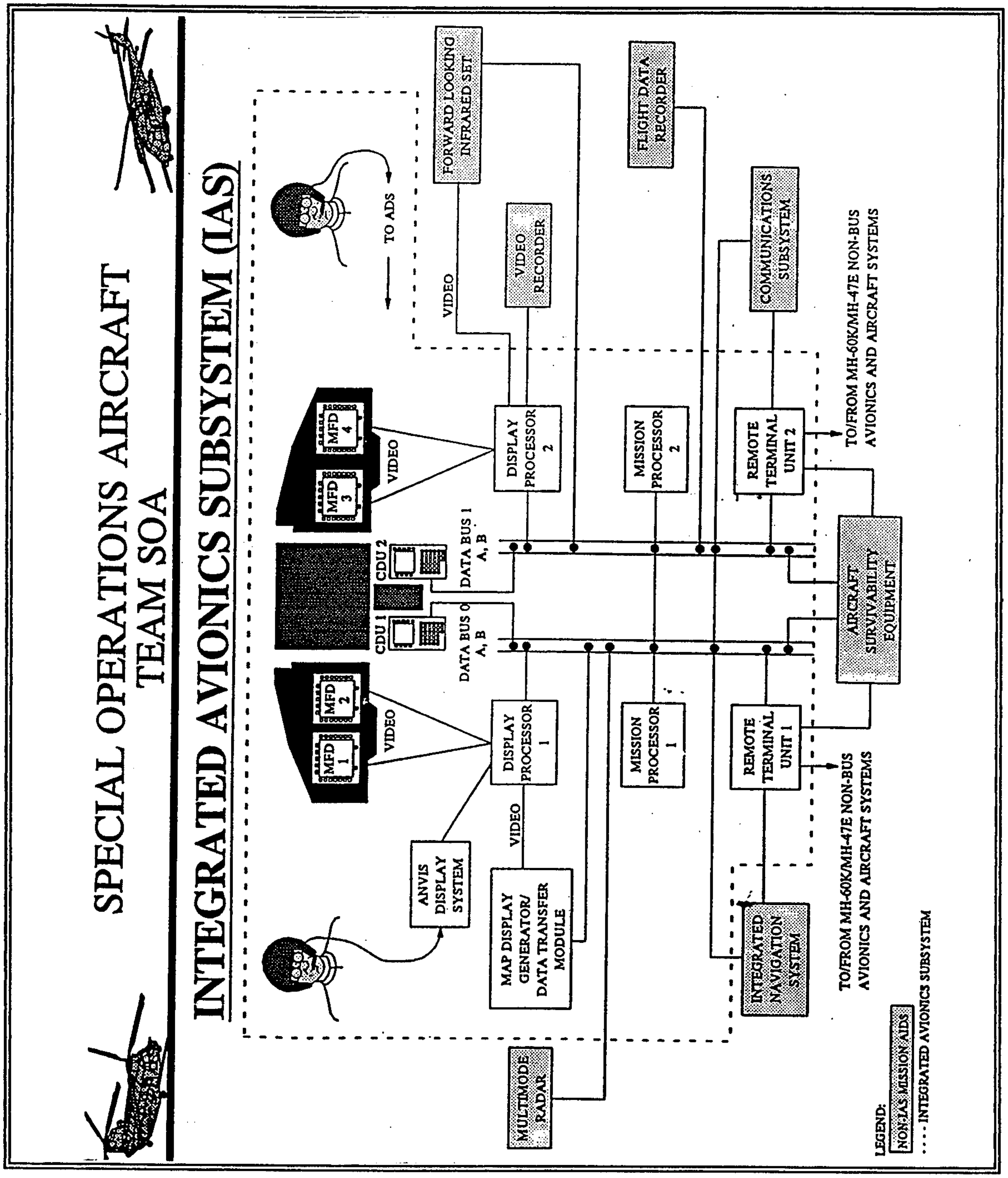

Figure 3.1. IAS Block Diagram From [Ref. 16]

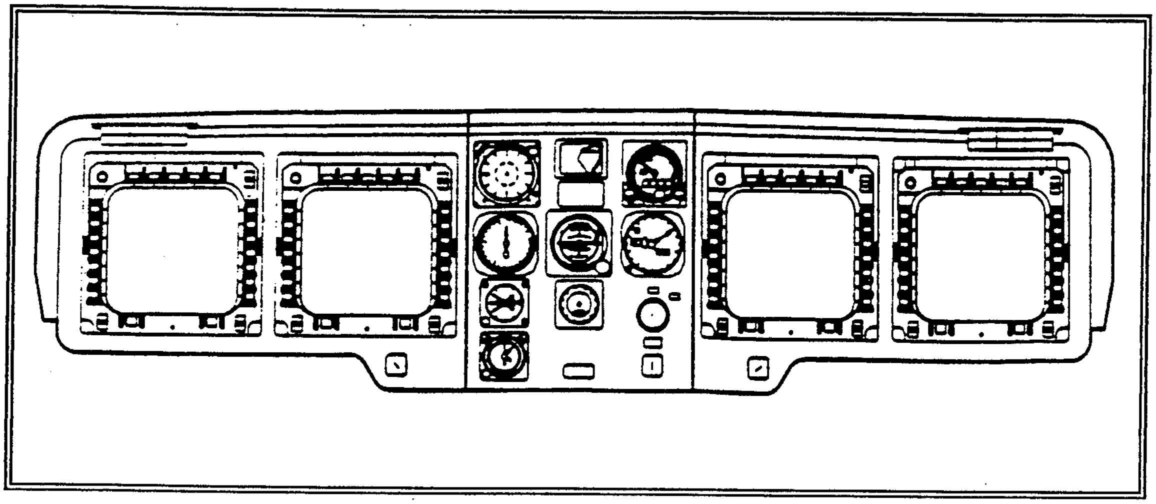

Figure 3.2. MFDs in MH-60K From [Ref. 15]

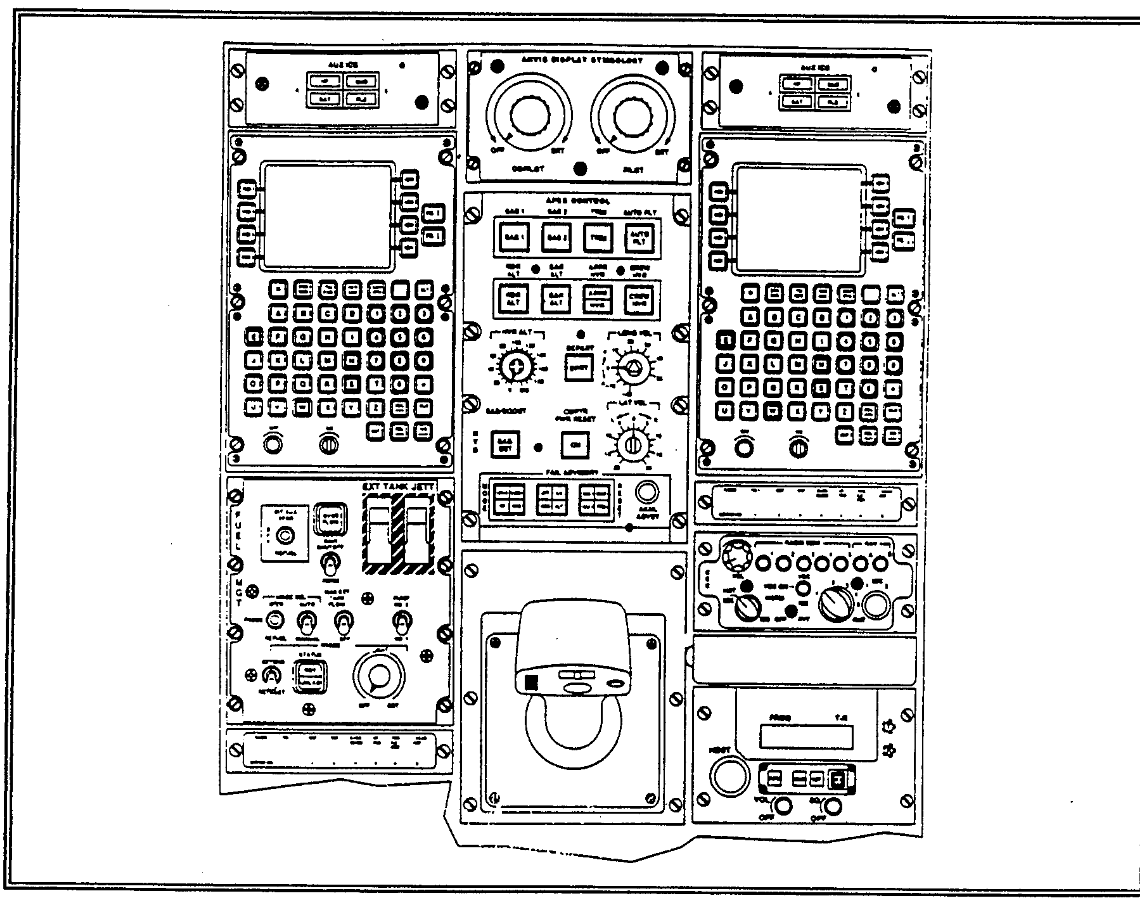

Figure 3.3. CDUs in MH-60K From [Ref. 15]

Two Display Processors (DP), located in the avionics compartment, provide display symbology in response to commands from the MPs based on MFD key depressions and screen control in response to commands from the MFDs. [Ref. 16]

Two Military Standard (MIL-STD) 1553B dual standby redundant multiplex data buses provide the interface between the CMS components and the 1553B bus-compatible helicopter systems. [Ref. 16]

(2) Communications / Identification System. The communications / identification system integrates numerous pieces of military communications equipment, communications security equipment, and identification friend or foe (IFF) equipment into a "user friendly" system controllable through a single CDU instead of through 15 separate control heads. The following components comprise the communications / identification system (See figure 3.1 and Appendix B for basic interfaces.) [Ref. 16]

Communications Control Unit, C11746(V)3/ARC. The C11746 provides intercommunications between crewmembers and control of navigation and communication radios through the RTU interface with the CMS. [Ref. 15]

VHF-FM Radio, ARC-186(V). The ARC-186 provides two-way FM communications of voice and data in the 30.000 to 87.975 MHZ frequency range, and AM voice and data reception from 108.000 to 115.975 MHZ frequency range. [Ref. 15]

Single Channel Ground and Airborne Radio System (SINCGARS), AN/ARC-201A(V). The ARC-201 provides two-way FM communication of voice and data in the 30.00 to 79.75 MHZ frequency range. [Ref. 15]

FM Amplifier, AM-7189A/ARC. The AM-7189 provides amplified output to the ARC-201. [Ref. 15]

UHF-AM (HAVEQUICK II) Radio, AN/ARC-164(V). The ARC-164 provides two-way AM communications of voice and data in the 225.000 to 399.975 MHZ frequency range. [Ref. 15]

HF Radio, AN/ARC-199(V). The ARC-199 provides two-way AM, Upper Frequency Sideband (USB), and Lower Frequency Sideband (LSB) communications of voice in the 2.000 to 29.999 MHZ frequency range. [Ref. 15]

SATCOM UHF Radio, LST-5C. The LST-5 radio provides two-way AM or FM voice communications via satellite, or to ground based stations in the 225.000 to 399.995 MHZ frequency range. [Ref. 15]

Voice Security System, KY-58/TSEC and Voice Security RCU/Processor, KY-75/TSEC. Provisions are included for three KY-58s and one KY-75. The KY-58 provides secure voice and data communications for the ARC-201, ARC-186, ARC-164, and the LST-5C radios. The KY-75 provides secure voice and data communications for the ARC-199 radio. [Ref. 15]

Ground Communications Radio, SABER. The SABER radio provides voice communications over the 136.000 to 168.000 MHZ frequency range. [Ref. 15]

Airborne Target Handover System (ATHS), CP-1516/ANS141. The ATHS provides digital message transmission and reception capability controlled and displayed via the CMS. ATHS may be used with the ARC-201, ARC-164, and the LST-5. [Ref. 15]

Identification, Friend or Foe (IFF) Transponder, AN/APX-100(V). The APX-100 receives IFF interrogation at a frequency of 1030 MHZ, originated and directionally beamed by a ground or airborne challenging station. The APX-100 detects the radio interrogation signals, recognizes the discrete pulse spacings, and activates transmission at 1090 MHZ of the properly coded reply pulse trains. [Ref. 15]

Transponder Computer, KIT-1C/TSEC. Provisions are included for the KIT-1C. The KIT-1C is used for decoding interrogations and encoding transmissions of the APX-100. [Ref. 15]

(3) Integrated Navigation System. The integrated navigation system links nine navigation systems together through the 1553B data bus and gives the pilot access to all available navigational data through the CDUs and MFDs. The following components comprise the integrated navigation system (See Figure 3.1 and Appendix B for basic interfaces.) [Ref. 15]

Inertial Navigation Unit (INU), CN-1656/ASN-141. The INU provides real-time aircraft position and velocities. [Ref. 15]

Attitude and Heading Reference System (AHRS), AN/ASN-145. The AHRS provides accurate outputs of pitch, roll, and heading information. It receives data of the earth's magnetic field from the ML-1 magnetic heading sensor (flux valve). [Ref. 15]

Global Position System (GPS), AN/ASN-149(V)2. The GPS provides three dimensional position determination, velocity, and time information to the MPs. The GPS is integrated with the INU and the Doppler navigation systems. [Ref. 15]

Doppler Navigation System, AN/ASN-137. The doppler navigation system is a secondary aiding sensor which provides highly accurate body frame velocities to the MPs. The MPs send doppler velocity information to the GPS, INU, and AHRS. [Ref. 15]

Automatic Direction Finder Set (ADF), AN/ARN-149(V)2. The ADF operates within the frequency range of 100 to 299.5 KHZ. It is a navigational radio aid which provides a visual indication of the aircraft's relative bearing to low and medium frequency Non-Directional Beacons (NDBs) or standard broadcast stations. [Ref. 15]

VOR/ILS, AN/ARN-123(V). The VOR/ILS receives automatic VHF Omnidirectional Radio (VOR) bearing; marker beacon (MB) position; localizer (LOC) and Glideslope (GS) information for en route and terminal navigation; and Instrument Landing System (ILS) approaches and landings. The VOR/ILS receiver section processes VOR and LOC signals over the frequency range of 108.00 to 117.95 MHZ. The 40 channel GS receiver section processes GS signals over the frequency range of 329.15 to 335.00 MHZ. The MB receiver processes 75 MHZ MB signals. [Ref. 15]

TACAN, AN/ARN-118(V). The TACAN is a short range omnibearing, distance measuring navigation system that provides continuous indication of the bearing and distance of the aircraft to any TACAN surface beacon within a line-of-sight distance of 390 nautical miles. In addition, this system may be used to determine the line-of-sight distance to another aircraft equipped with similar TACAN equipment. [Ref. 15]

Personnel Locator System (PLS), AN/ARS-6(V)3. The PLS provides the relative position of downed aviators equipped with the AN/PRC-90 or AN/PRC-112A(V) survival transponder radio. [Ref. 15]

Radar Beacon Transponder, AN/APX-105. The APX-105 is included to provide assistance with refueling tankers. Adequate encoding provisions are incorporated to enable aircrews, in interrogating support aircraft, to readily identify beacon modes. [Ref. 15]

Radar Altimeter, AN/APN-209(V). The radar altimeter provides an accurate indication of the absolute altitude of an aircraft over all types of terrain surfaces. [Ref. 15]

(4) Mission Aids. The mission aids portion of the IAS includes a conglomeration of systems which aid the pilot in the successful completion of various special operations missions. The mission aids suite is comprised of the following systems (See figure 3.1 and Appendix B for basic interfaces.) [Ref. 15]

Multimode Radar (MMR), AN/APQ-174A. The MMR is an airborne forward-looking radar with Terrain Following (TF) and Terrain Avoidance (TA) as the primary modes of operation to enable night and all-weather operational flights. [Ref. 15]

Map Display Generator (MDG). The MDG generates and displays a presentation of aircraft position and other navigational data in a pictorial form superimposed over a moving map. [Ref. 15]

ANVIS Display Symbology System. The ANVIS Display System is used in conjunction with the ANVIS night vision goggles. Flight display symbology is presented to the pilot and copilot as viewed through the ANVIS goggles. [Ref. 15]

Forward Looking Infrared (FLIR), AN/AAQ-16B. The FLIR is a modular night vision sensor capable of being integrated with the cockpit displays to provide

the flight crew with long range detection, recognition, and navigation capabilities during total darkness. The FLIR provides imagery to aid and assist ANVIS equipped pilots during night, low level en route, nap-of-the-earth, and terminal area maneuvers, and during search and rescue operations. The FLIR also provides an independent night pilotage backup capability under overcast or moonless skies where ANVIS capabilities are marginal or inadequate. [Ref. 15]

R2548/AXQ Video Recorder. The video recorder tapes tactical information for retention at the conclusion of the mission. The video recorder tapes using images provided from the FLIR systems visual display. Time and position data is superimposed on the tape. [Ref. 15]

Emergency Locator Transmitter (ELT), EBC-302SHM. The ELT transmits a signal to aid in the location of a downed aircrew. The ELT operates on 121.5 and 243.0 MHZ. [Ref. 15]

b. Aircraft Survivability Equipment (ASE)

The ASE integrated into the SOA is one of the most impressive suites of air-defense detection and defense equipment every assembled on a single airframe. Although the ASE suite is not part of the IAS, it is controlled through systems in the IAS. Figure 3.1 and Appendix B show the relationship between the IAS and the ASE suite. As with the components of the IAS, the ASE suite is connected to the 1553B data buses and is controlled by the pilots through the CDUs. The following components comprise the ASE suite. [Ref. 15]

(1) Detection Equipment.

Pulsed Radar Warning Receiver, AN/APR-39A(V)1. The APR-39 provides warning of radar-directed threats to allow appropriate evasive maneuvers and deployment of active countermeasures. It uses a digital processor, alphanumeric display, and synthetic voice warning to provide warning of radar-directed air defense threat systems. The system has the capability of detecting all pulse radars normally associated with hostile surface-to-air, airborne intercept, or antiaircraft weapons. [Ref. 15]

Laser Detection Set, AN/AVR-2A. The AVR-2 is a passive laser warning system that receives, processes, and displays threat information resulting from aircraft illumination by lasers. The threat information is displayed on the APR-39 indicator. [Ref. 15]

Radar Warning System, AN/APR-44(V)3. The APR-44 Radar Warning System alerts the aircrew to radar threats from surface-to-air missiles and airborne intercept missiles. The alert is provided by aural warning through the intercom system and visual indicator light. [Ref. 15]

Missile Warning Set (MWS),AN/AAR-47. The MWS is a passive missile detector that automatically cues the M-130 Flare / Chaff Dispenser. [Ref. 15]

(2) Defensive Equipment.

Pulsed Radar Jammer, AN/ALQ-136(V)2. The ALQ-136 is an automatic radar jammer that analyzes various incoming radar signals. When the signals are identified as coming from a threat source, jamming automatically begins, and is continuous until the threat radar breaks lock. [Ref. 15]

Continuous Wave (CW) Radar Jammer, AN/ALQ-162(V)2. The ALQ-162 provides warning and protection against surface-to-air missiles and airborne intercept missiles that use CW radar for guidance. When CW signals detected by the system are validated, jamming is initiated and warning is given to the crew. [Ref. 15]

M-130 Flare / Chaff Dispenser. The M-130 system dispenses flare decoys and chaff bundles. The system can be operated manually, or it can be automatically cued by the AAR-47 Missile Detector. [Ref. 15]

(3) Other Equipment. Other equipment included in the ASE suite include the Interference Blanker Unit (IBU), CN-1493/A. The IBU is designed to effect blanking, look-through, and priority between ASE and other systems to enable maximum effectiveness of the ASE. [Ref. 15]

c. Armament

The aircraft are structurally modified to accept two GE, 7.62mm mini-guns capable of firing at a sustained rate of 2000 or 4000 rounds per minute. The guns are pintle mounted and allow unrestricted fields of fire throughout the required azimuth. [Ref. 15]

d. Fuel Systems

The SOA are modified and equipped to accommodate a variety of fuel system configurations. There are slight differences in the fuel system modifications between the MH-60K and the MH-47E, but the resulting increase in range brings both aircraft up to the required operational capability specified. The following subsystems comprise the modifications to the SOA fuel systems.

(1) Aerial Refueling Probe. A composite aerial refueling probe is attached to the right side of the airframe. This refuel probe gives the SOA the ability to conduct air-to-air refueling with a variety of host tanker aircraft. This system effectively gives the SOA self-deployability to anywhere in the world. [Ref. 15]

(2) Internal Auxiliary Fuel Tanks. The MH-60K can be fitted with up to four internal auxiliary tanks with a capacity of 172 usable gallons each. The MH-47E can be fitted with up to four 800 gallon internal auxiliary tanks. [Ref. 14 and 15]

(3) External Tank Supports (ETS). The MH-60K can be fitted with ETS structures in order to carry one 230 gallon composite tank externally on each side of the aircraft. [Ref. 15]

(4) Long-Range Fuel Tanks. The MH-47E is modified to carry fuel in two 1000 gallon pods, one on each side of the fuselage. This standard fuel load essentially doubles the total capacity of the CH-47D. [Ref. 14]

e. Transmissions

The MH-60K is equipped with an "improved durability" gear box (main transmission) developed for the Navy. [Ref. 15]

f. Engines

The MH-47E is equipped with a Lycoming T55-L-714 high performance turbine engine. The engine improves performance in hot weather and high altitude through the use of a Full Authority Digital Engine Control (FADEC). [Ref. 14]

g. Other Systems

The SOA are equipped with various other systems which facilitate the accomplishment of specific SOF missions. The following systems constitute the remainder of the MEP.

(1) Rescue Hoist. A hydraulically powered and electrically controlled rescue hoist is fitted externally above the main cabin door. The rescue hoist is capable of raising 600 pounds at controlled speeds of up to 100 feet per minute with 245 feet of usable cable. [Ref. 14]

(2) Rotor Brake. The SOA are equipped with a manually operated, hydraulically actuated rotor brake which can be used to hold the rotors stationary while starting the first engine and to stop the rotors during engine shut down. The rotor brake is a critical component for shipboard operations. [Ref. 14]

(3) Fast Rope Insertion Extraction System (FRIES). The SOA are structurally modified to accept FRIES hardware. Attachment of the Government furnished hardware makes the SOA, FRIES mission capable. [Ref. 14]

h. Software

Although the software that integrates the various subsystems into a usable system is not a "component" of the MEP, I would be remiss in not mentioning it here as an integral part of the program. Over 380,000 source lines of code went into the integration of the IAS and ASE subsystems. It is through this integrating software that the SOA are actually able to perform to their required operation capability. [Ref. 17]

C. THE SOA INTEGRATED LOGISTICS SUPPORT PLAN

It should be obvious from the system description above that the MH-60K and MH-47E are among the most complex aircraft in the world today. Even with this complexity, however, the SOA Program was designated an NDI program. As such, the entire program was under an accelerated time line for completion and fielding. With these constraints, it was especially important for the acquisition logisticians to be involved early in the acquisition process in order to influence the program in terms of ILS.

The ILSP is the principle logistics document for an acquisition program. It describes the overall ILS program and provides a complete plan for support of the deployed system. The quality and thoroughness of the ILSP is usually a good indicator of the quality and thoroughness of the ILS effort. The following sections describe the ILSP of the SOA Program.

1. SOA ILSP Overview

The SOA Program had a separate ILSP for the MH-60K and the MH-47E. In general, these documents were identical and will be considered one and the same for the purposes of describing the SOA Program's ILSP. Where significant differences were noted, they will be highlighted accordingly.

The SOA Program's ILSP followed the format directed by Department of the Army (DA) Pamphlet 700-55, "Instructions for Preparing the Integrated Logistics Support Plan." [Ref. 9] Section I, entitled "General", consisted of background and general information. This information included, but was not limited to, the purpose of the program, the program background, and a description of the system. (See Chapter II, Section B.4.a.(1) of this thesis

for a more complete description of the contents of Section I.) The information contained in Section I of the SOA ILSP has already been covered in Section B of this chapter and will not be discussed further.

Section II, entitled "Plans, Goals, and Strategy, consisted of eight subsections: (1) Operational and Organizational Plans; (2) System Readiness Objectives; (3) Acquisition Strategy; (4) Logistics Support Analysis Strategy; (5) Supportability Test and Evaluation Concept; (6) ILS Element Plans; (7) Support Resource Funds; and (8) Post-Fielding Assessments. This Section will be discussed in more detail below.

Section III, entitled "ILS Milestone Schedule", consisted of several milestone charts and calendars. See Appendix C for the details of those schedules. Other than the inclusion of the actual schedules in Appendix C, Section III will not be discussed further.

2. SOA ILSP Section II: Plans, Goals, and Strategy

a. Subsection 1: Operational and Organizational Plan

The Operational and Organizational (O&O) Plan, as defined by the SOA ILSP, was:

> The SOA will be primarily used for long range insertion, extraction and resupply of Army, Navy, and Air Force Special Operations Forces (SOF) personnel. The aircraft will provide a means for rapid deployment of forces and equipment into combat for counter-terrorism actions, strategic intelligence strikes, tactical reconnaissance, and infiltration and interaction at night, during periods of adverse weather and during reduced visibility conditions. Other operational missions will be light infantry operations in support of special operations, contingencies, and civil affairs and psychological operations. [Ref. 18]

b. *Subsection 2: System Readiness Objectives*

The SOA Reliability, Availability, and Maintainability (RAM) objectives were based on the following five criteria: (1) Mean Time Between Essential Maintenance Actions (MTBEMA); (2) Mean Time Between Mission Abort (MTBMA); (3) Mean Time To Repair (MTTR) at the Aviation Unit Maintenance (AVUM) level; (4) Operational Availability (Ao) based on a Fully Mission Capable (FMC) status and a Mission Capable (MC) status; and, (5) Direct Maintenance Man-hours per Flight Hour (DMMH/FH) based on total AVUM and Aviation Intermediate Maintenance (AVIM) level work. [Ref. 18]

Table 3.3 depicts the system readiness objectives identified in the SOA ILSP. A 1200 flight hour (FH) Reliability Validation (utilizing production aircraft) was scheduled to assess the degree to which these objectives were actually met.

SYSTEM READINESS OBJECTIVES		
Criteria	**MH-60K**	**MH-47E**
MTBEMA	3.0 hours	3.0 hours
MTBMA	52 hours (for 5.5 hour mission)	52 hours (for 5.5 hour mission)
MTTR	1.0 hour	1.0 hour
Ao: FMC	0.80	.70
Ao: MC	0.85	.70
DDMH/FH	11.6 hours	11.6 hours

Table 3.3. SOA ILSP System Readiness Objectives [Ref. 18 and 19]

c. *Subsection 3: Acquisition Strategy*

The Acquisition Strategy, as defined by the SOA ILSP, was based on two prime contractors, Sikorsky Aircraft (SA) for the MH-60K, and Boeing Helicopter Company (BHC) for the MH-47E, having total system performance responsibility for their respective

aircraft. The only stipulation was that each prime would use the Government directed subcontractor of IBM for the IAS.

The Acquisition Strategy subsection of the SOA ILSP was further broken down into seven areas. Those areas are discussed below.

(1) Life-Cycle Cost. A Life-Cycle Cost (LCC) analysis was performed in September 1986 on the SOA MEP using a generic LCC model tailored to suit the small number of modified aircraft and the equipment complexity. The LCC analysis was used during technical and cost evaluation of both the SA and BHC proposals to assure "continuing control of Operation and Support (O&S) costs." [Ref. 18] The SOA ILSP stated that the LCC analysis revealed that "minimum life-cycle costs could be realized with the implementation of the following:

- A contractually required SA and BHC reliability and maintainability (R&M) program to minimize O&S costs.
- The use of Interservice Supply Support Agreements (ISSAs) whenever possible for the support of hardware and software currently in use by other services.
- The use of contractor logistic support above the AVUM level.
- A two level maintenance concept." [Ref. 18]

(2) Support Risks. SA and BHC were contractually required to maximize the use of on-board troubleshooting and built-in tests (BIT). The goal of this requirement was to provide fault detection, along with fault isolation of all failures detected.

To further reduce support risks, the SOA ILSP directed that the Logistics Support Analysis (LSA) process be used to determine and define logistic support and personnel tasks and skills for the operation, maintenance and support of the system. It also

directed that, to the maximum extent possible, equipment and operational and diagnostic software be compatible with existing systems or systems in the process of being developed. [Ref. 18]

(3) Manpower and Personnel Integration Requirements. The SOA Manpower and Personnel Integration (MANPRINT) Program was tailored to be consistent with the NDI nature of the program. The tailoring was driven by the specific aircraft to be modified, the special equipment to be integrated into the aircraft, and the unique SOF organization receiving the SOA. [Ref. 18]

(4) Source Selection. A sole source, firm-fixed price letter contract was signed by BHC, for the MH-47E, on 2 December 1987, and by SA, for the MH-60K, on 26 January 1988. The contracts were for the design and development of a prototype aircraft (one of each type) that met ROC requirements. The SOA ILSP stated that ILS considerations were a major factor in the source selection process in order to ensure that the MEP, not only met performance requirements, but was also economically supportable. [Ref. 18]

(5) Reliability, Availability, and Maintainability. The reliability and maintainability (R&M) program included quality engineering, parts control, standardization, and warranty program requirements. The SOA ILSP directed that RAM be addressed in accordance with selected requirements contained in the SOA specification. The purpose of these efforts was to ensure that SOA RAM was consistent with ROC requirements. [Ref. 18]

(6) Elements of Support Acquisition. The following ILS elements were included in the solicitation documents and were required to be addressed in the contractor's ILS program: [Ref. 18]

- Maintenance Planning
- Support and Test Equipment
- Supply Support
- Transportation and Transportability
- Technical Data
- Manpower and Personnel
- Training and Training Devices
- Facilities
- Computer Resources Support
- Packaging, Handling, and Storage
- Design Influence
- Standardization and Interoperability

(7) Transportability. Transportability requirements were included in the SA and BHC contracts. They called for the MH-60K to be C-5, C-141, and C-17 transportable and for the MH-47E to be C-5 transportable. [Ref. 18 and 19]

(8) Software Systems Engineering Configuration Control Management. (Only included in the MH-60K ILSP.) SA was directed to provide software system integration logistical support for the MH-60K, in accordance with the prime item development specification (PIDS) baseline submitted by SA. [Ref. 19]

The Aviation Systems Command (AVSCOM, now the Aviation and Troop Command or ATCOM) Directorate for Life Cycle Software Engineering was

responsible for the management of Post-Deployment Software Support (PDSS) for the SOA program after the aircraft were fielded. [Ref. 19]

(9) Hardware Systems Engineering Configuration Control Management. (Only included in the MH-60K ILSP.) The MH-60K ILSP stated that the following agencies were responsible for the appropriate support. The U.S. Army Avionics Research and Development Activity was responsible for providing avionics systems engineering support. The AVSCOM Directorate for Engineering was responsible for providing airframe systems engineering support. And the AVSCOM Directorate for Maintenance was responsible for automatic test equipment (ATE) / test program sets (TPS). Overall configuration control of the aircraft remained with PM SOA. [Ref. 19]

d. Subsection 4: Logistic Support Analysis Strategy

The SOA Program was essentially an electronics modification to existing fielded aircraft. As a result, the Logistic Support Analysis (LSA) / Logistics Support Analysis Record (LSAR) strategy was tailored to meet the NDI nature of the program and the streamlined acquisition process. In general, where fielded systems were adopted and installed to meet the requirements of the program, Army, Navy, or Air Force technical publications, engineering drawings, and cataloging information were utilized for the purpose of the program. If the adopted and installed system was a commercially available item, the available commercial data was converted to Army format and used.

LSAR data was to be prepared for AVUM level systems for each aircraft. The prime contractors prepared integrated support plans (ISPs) that specified how spares quantities would be computed to support the test program as well as the production aircraft.

Publications, engineering drawings, LSAR data, and training literature were to be provided by SA for the MH-60K and by BHC for the MH-47E. [Ref. 19]

(1) LSA Tasks. Table 3.4 identifies the tailored LSA tasks that were scheduled to be accomplished for each aircraft. MIL-STD-1388-1A, "Logistics Support Analysis," [Ref. 10] was used as a guide in selecting these tasks.

SOA TAILORED LSA PROGRAM	
Tasks performed for the MH-60K	Tasks performed for the MH-47E
101 LSA Strategy	**101** LSA Strategy
102 LSA Plan	**201** Use Study
103 Program and Design Review	**202** Standardization
301 Functional Requirements Identification	**203** Comparative Analysis
301.2.4 Operations and Maintenance Tasks	**204** Technological Opportunities
301.2.4.1 Identify Corrective Maintenance Tasks	**301** Functional Requirements Identification
301.2.4.2 Identify Preventive Maintenance Tasks	**302** Support System Alternatives
401 Task Analysis	**303** Evaluation Tradeoffs
401.2.1 Task Analysis	**402** Early Fielding Analysis
401.2.2 Analysis Documentation	
401.2.3 New/Critical Support	
401.2.4 Training Requirements	
401.2.6 Management Plans	
401.2.7 Transportability Analysis	
401.2.8 Provisioning Requirements	
401.2.9 Validation	
401.2.10 ILS Output Products	
401.2.11 LSAR Updates	
402 Early Fielding Analysis	
402.2.4 Combat Resource Requirements	

SOA TAILORED LSA PROGRAM	
Tasks performed for the MH-60K	Tasks performed for the MH-47E
501 Supportability T&E and Verification	
501.2.2 Objectives and Criteria	
501.2.3 Updates and Corrective Actions	
501.2.5 Supportability Assessment	

Table 3.4. SOA Tailored LSA Program [Ref. 18 and 19]

(2) MH-60K Sources of LSA Documentation. The LSAR for the UH-60A, MANPRINT, and support equipment recommendations were the primary data sources for the MH-60K LSA effort. [Ref. 19]

(3) MH-47E Sources of LSA Documentation. BHC did not accomplish LSA/LSAR on the CH-47D. Instead, a Maintenance Engineering Analysis (MEA) was done. BHC used a software conversion program to format MEA documentation to LSAR formats. [Ref. 18]

*e. **Subsection 5: Supportability Test and Evaluation Concept***

Specifics on the SOA supportability test and evaluation (T&E) concept were included in the SOA Test and Evaluation Master Plan (TEMP). During the Technical Test (TT), the aircraft were flown and supported by the prime contractors. During the Preliminary Airworthiness Evaluation (PAE), the aircraft were flown by the Army and supported by the prime contractors. During the follow-on test and evaluation (FOT&E), the aircraft were flown by the Army and supported by Contractor Logistics Support (CLS) and Army AVUM. [Ref. 19]

f. Subsection 6: ILS Element Plans

(1) Design Influence. On the overall system design of peculiar [1] parts, SA and BHC were contractually required to give equal emphasis to ILS activities, technical activities, and cost activities. The SOA ILSP directed that, to the maximum extent possible, MH-60K and MH-47E hardware and software were to be compatible with existing operational systems. Where new systems were developed and introduced into the inventory, they were to be logistically supportable by the existing support organization. [Ref. 18]

(2) Maintenance Plan. The maintenance plan for the SOA consisted of a combination of Army and CLS. This plan called for a "two level" system of maintenance. Level one consisted of Army personnel performing all AVUM level tasks and all AVIM common [2] tasks. Level two consisted of contractor personnel performing all AVIM peculiar tasks and all Depot level tasks under CLS. CLS would also provide technical back up support for the Army AVUM and AVIM common maintenance. It was the intent of the SOA Program and the user to have CLS for the life of the system. (CLS is now known as Life-Cycle Contractor Support, or LCCS.) [Ref. 18]

The maintenance concept under this two level maintenance plan was to have the unit troubleshoot and isolate the faulty component at the AVUM / AVIM common level. After fault isolation, the unit would remove and replace the faulty component at the AVUM / AVIM common level. The unit would also perform on-aircraft and in-shop AVUM

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[1] Peculiar, as used in the SOA ILSP, refers to any subsystem, part, equipment, wiring, mount, software, etc., not currently on the UH-60L or the CH-47D.

[2] Common, as used in the SOA ILSP, refers to any subsystem, part, equipment, wiring, mount, software, etc., that is currently on the UH-60L or the CH-47D.

/ AVIM common maintenance actions. Contractor personnel would perform AVIM peculiar and Depot level maintenance and on-aircraft AVIM peculiar and Depot level maintenance actions. There were no plans to organically repair or overhaul failed peculiar components due to the "limited" quantities of those items. [Ref. 18]

(3) MANPRINT. The SOA MANPRINT Program was tailored to be consistent with the NDI nature of the program. Four MANPRINT elements were addressed in the program: (1) human factors; (2) system safety; (3) biomedical health and hazard; and (4) training. No increase in manpower and no new Military Operational Specialties (MOSs) were deemed necessary. [Ref. 18]

(4) Supply Support. The prime contractors were directed to maintain a "100 percent LSA-036/PMR" (Provisioning Master Record) data base that was compatible with the Commodity Command Standard System (CCSS). This requirement afforded the Government the flexibility to establish a total provisioning master data record should the determination ever be made to organically support the SOA. The provisioning process was a joint effort between the Government and the prime contractors. However, the Government made the final decision on coding, range, and quantity of spare parts. [Ref. 18]

(5) Support Equipment and TMDE. The SOA MEP was designed to be fault isolated through Built in Test (BIT) and Built in Test Equipment (BITE). AVUM and AVIM common level maintenance on the MEP consisted of fault isolation to the Line Replaceable Unit (LRU) level and replacement of faulty LRUs. The SOA ILSP directed the maximum use of standard tools and Test, Measurement, and Diagnostic Equipment (TMDE) in the design of the MEP. [Ref. 18]

The primary support equipment (SE) effort was on the screening of all SE requirements identified through design, maintenance, LSA, and LCC and ILS trade off studies. Those activities were to result in a recommendation of an SE candidate that best satisfied the need for each maintenance task. The recommendation process was to provide the most cost effective and work efficient mix of ground-based versus built-in support features for maximum aircraft self-support capability. [Ref. 18]

(6) Training and Training Devices. The SOA training system was based on an Integrated Training System (ITS). It included all programs of instructions (POIs), technical and courseware material, and devices necessary to train operator, maintainer and support (OMS) personnel for the aircraft and MEP at AVUM level. As part of the ITS, the prime contractors were responsible for: (1) Providing factory training for Government personnel to meet test requirements; (2) Providing, maintaining, supporting, and delivering all training hardware ,software, and courseware required to conduct factory training; (3) Providing each student with a training package; and (4) Providing Instructor and Key Personnel Training (IKPT) to include all training documentation necessary for establishing Government new equipment training (NET) and institutional training capabilities. [Ref. 18]

A Training Device System (TDS) was the basis for determining training device requirements and utilization. The design of the SOA TDS was based on the SOA ITS characteristics of traceable, hierarchical relationships to the OMS tasks for which each individual device would be used. The TDS suite of devices included: (1) Combat mission simulators (one MH-60K and one MH-47E); (2) Cockpit procedural trainers; (3) Part task trainers; (4) Classroom trainers; and (5) Maintenance trainers. [Ref. 18]

(7) Technical Data. The prime contractors were directed to utilize current standard aircraft manuals as the baseline for the development of SOA aircraft manuals. All publications to support the MH-60K and MH-47E production were to be commercially prepared, updated, stocked, stored, and issued by their respective prime contractors. [Ref. 18]

(8) Computer Resources Support. Embedded computer hardware and software was specified and treated as configuration items and as integral parts of the system and applicable subsystems. A computer resource management plan (CRMP) was developed and maintained for each aircraft. [Ref. 19]

(9) Packaging, Handling, and Storage. The ILS aspects of Packaging, Handling, and Storage (PHS) included consideration of special equipment, reusable containers, preservation materials, and other items needed to ensure adequate protection of items during shipment, handling, and storage. Existing PHS equipment and procedures were evaluated to determine their applicability to the SOA Program. The overall effort was coordinated with AVSCOM and the AMC Packaging, Storage, and Containerization Center. [Ref. 18]

(10) Transportation and Transportability. The MH-60K was designed to be transportable by the following means: (1) By air in the C-141, C-5, and C-17 aircraft; (2) By ship on all ships presently employed for sea transport of UH-60A; (3) By road on any standard highway truck/semitrailer vehicle having an air-ride suspension system; and (4) By self deployment utilizing in-flight refueling and extended tank support. The MH-47E was designed to be transportable by the following means: (1) By air in the C-5 aircraft; (2) By ship on all ships presently employed for sea transport of CH-47D; (3) By road on any standard

highway truck/semitrailer vehicle having an air-ride suspension system; and (4) By self deployment utilizing in-flight refueling and extended tank support. [Ref. 18 and 19]

(11) Facilities. Existing UH-60L and CH-47D facilities were determined to be adequate with the exception of classified equipment storage. Detailed facilities requirements were documented in the Material Fielding Plans (MFPs). [Ref. 18 and 19]

(12) Standardization and Interoperability. The SOA Program modifications did not affect the standardization and interoperability (S&I) of the modified aircraft. [Ref. 18]

g. Subsection 7: Support Resource Funds

Preliminary estimates of costs to acquire and support the SOA were developed and included in each ILSP. The estimated cost of acquisition was based upon an Independent Government Cost Estimate (IGCE) and was in accordance with the current Program Objective Memorandum (POM) for 23 MH-60Ks and 17 MH-47Es. The costs, as listed, were within the fiscal year (FY) 1987 through 1993 procurement funding profile and were adequate to cover the quantity of aircraft as outlined in the POM. [Ref. 18 and 19]

h. Subsection 8: Post-Fielding Assessments

The requirements for an initial fielding assessment and a post-provisioning review were assessed and addressed in the MFP. [Ref. 18 and 19]

D. CHAPTER SUMMARY

ILS in NDI acquisition programs is unarguably one of the most challenging aspects of doing business in this accelerated environment. The fact that a program plans on only

procuring a small number of systems, and that those systems are among the most technologically advanced in the world, further complicates the issue. That was just the situation that the SOA Program was facing at its inception in 1986.

This chapter provided a detailed description of the SOA MEP in an attempt to provide the reader with an understanding of the technologically advanced systems that the SOA Program was tasked with integrating. The chapter also provided an overview of the SOA ILSP in order to give the reader an appreciation of the ILS planning that went into the SOA Program.

It is imperative to remember that the ILSP is the principle logistics document for an acquisition program. It was my premise at the start of section C in this chapter that the quality and thoroughness of the ILSP is usually a good indicator of the quality and thoroughness of the ILS effort. The SOA ILSP appears to be a quality, thorough document, but was it successful at planning and implementing an effective ILS program at the user level? That is the topic of the next chapter.

IV. ANALYSIS AND IDENTIFICATION OF MAJOR FACTORS

A. INTRODUCTION

As you will recall from chapter one, the primary assumption that I made in this thesis is that logical and useful ILS lessons learned can be derived from an analysis of a recently implemented ILSP. Another key assumption that I made in conjunction with this first assumption is that personnel intimately involved with the implementation of an ILSP are the most qualified to provide realistic, current, and relevant insight into the ILS process.

Given these assumptions, the analysis of the SOA Program's ILSP was conducted by utilizing interview comments from three groups of people. Those three groups included Technology Application Program Office (TAPO), or Program Management (PM) personnel, Boeing / Sikorsky Aircraft Services (BSAS), or contractor personnel, and 160th Special Operations Aviation Regiment (Airborne) (SOAR(A)), or user personnel. Each of these groups of personnel is intimately involved with the logistical support of the SOA. Their comments were used to assess the challenges of implementing the SOA Program's ILSP and thereby deducing the major factors which had a significant impact on the development and implementation of that ILSP.

The advantage of using three different groups of personnel as the basis for conducting the analysis is that it provides three different perspectives on the challenges of the development and implementation of the ILSP. The PM provides a macro perspective on the entire SOA supportability arena with an emphasis on what has caused problems at the development and sustainment level. The user provides a candid, personalized perspective on what is going, or

has gone, wrong with the actual hands on support of the aircraft. And the contractor provides a nongovernment, professional appraising perspective on supportability as constrained by the Life-Cycle Contractor Support (LCCS) concept. Combining these three perspectives results in a synergistic perspective that provides the basis for an accurate evaluation of the development and implementation of the SOA Program's ILSP.

This chapter is comprised of two main sections. The first major section consists of an analysis of the following four elements of ILS: (1) Maintenance Planning; (2) Supply Support; (3) Support Equipment; and (4) Technical Data (Maintenance and Operator Publications). As described above, the analysis is conducted by utilizing interview comments on these four elements. The second major section consists of an identification of the "major factors" that I believe had a significant impact on the development and implementation of the SOA Program's ILSP. These factors were derived from the analysis conducted on the four elements of ILS examined.

The primary purpose of this chapter is to identify the major factors that had a significant impact on the development and implementation of the SOA Program's ILSP. These factors will then form the basis for developing the lessons learned and conclusions discussed in the next chapter. The secondary purpose of this chapter is to provide the reader with an opportunity to analyze, for themselves, the comments provided by the interviewees. From the reader's personal analysis, he or she may discover additional lessons learned or "pearls of wisdom"which may be applicable to their own specific program or situation.

B. ANALYSIS

The analysis is organized by ILS element, by interview group (i.e. PM, user, and contractor), and by category. The categories include: (1) the concept; (2) problems with the concept; (3) successes and failures; and (4) planning shortfalls. (Each category is not necessarily used in every ILS element analyzed.)

1. Maintenance Planning

DODI 5000.2, "Defense Acquisition Management Policies and Procedures" [Ref. 8] defines maintenance planning as "the process conducted to evolve and establish maintenance concepts and requirements for the lifetime of the system." Recall from chapter three that the maintenance concept for the SOA basically consists of a "two-level", LCCS arrangement where the user provides AVUM and common AVIM support and the contractor provides peculiar AVIM and depot support.

a. The PM's Perspective on the Maintenance Concept

The PM's perspective on the two-level LCCS maintenance concept is one of qualified support. Major Bill Parker, the Assistant PM (APM) for Material Readiness and Logistics at TAPO stated that if he had been in PM SOA when the concept was originally developed, he would tell you that LCCS is the way to go. Not necessarily because its <u>the</u> best way to support the aircraft, but because its the best way to support them given the manpower, funding, and training constraints present in the Army and especially in low density weapon system acquisitions. Major Parker went on to state that, since the aircraft have so much SOF peculiar equipment installed, the Army no longer has the capability to effectively maintain the aircraft by itself. [Ref. 20]

Major Parker qualified his support of the two-level LCCS maintenance concept by stating that he was not convinced that the LCCS contract, the way it is organized now, is the best way of doing business.

> I think we need to go back in and refine the statement of work (SOW) and fix the things we don't like. . . It comes back to the mission needs statement (MNS) and writing, not what you want, but what you need! We need to get all the smart people together, locked away somewhere away from the flagpole, away from the telephones, and say - lets define what we really need here. . . Lets look at the Military Occupational Speciality (MOS) structure, the hanger space, the organizational structure at the AVUM and AVIM levels and figure out what we can do smarter on the Army side of the house and then, determine what augmentation we need from outside contractors. . . We can blend that together and come up with a refined system based on what we've already got. [Ref. 20]

b. The User's Perspective on the Maintenance Concept

The user's perspective on the two-level LCCS maintenance concept is one of questionable usefulness in AVUM and AVIM support, and absolute necessity in depot level component support. Chief Warrant Officer (CW2) Steve Blasey, the AVUM Maintenance Technician in C Company, 1st Battalion, 160th SOAR(A) stated that LCCS involvement in the day to day maintenance of the aircraft doesn't provide them any additional capability over what they already possess. [Ref. 21] The point of no additional maintenance capability was also stated for AVIM maintenance capability by Major Mike Taliento, the F Company, 1st Battalion, 160th SOAR(A) AVIM commander and Major William Books, the D Company, 2nd Battalion, 160th SOAR(A) AVIM commander.

As for depot level maintenance support, Major Books stated that the two-level LCCS concept provides depot level repairs for the closed loop and peculiar components that would otherwise not exist. As far as airframe peculiar depot support goes, however, BSAS

simply provides duplicative modification work order (MWO) capability above and beyond what the existing DynCorps and E-Systems contracts already provide. [Ref. 22]

CW2 Blasey also stated that the maintenance concept for the MH-60K (and presumably for the MH-47E) had required a cultural shift for the Army mechanics and technicians. "Its a different philosophy in maintaining the aircraft. Black box replacement, BIT / BITE trouble shooting, automated logbooks, etc. . ." He went on to conclude, however, that, "we are starting to get institutional knowledge built up on the MH-60K. But at the beginning, we really didn't have a good understanding of the complete maintenance and supply concept." [Ref. 21]

c. *The Contractor's Perspective on the Maintenance Concept*

The contractor's perspective on the two-level LCCS maintenance concept is one of necessity. Mr. Mike Brickner, the BSAS Operations Manager, stated that he thinks that the LCCS concept is the only way that you can maintain a system that is as complex as the SOA and has as many "peculiar" components onboard. [Ref. 23] Mr. Kurt Porter, the BSAS Deputy General Manager reiterated that point with an example of how the concept was originally developed. He said that:

> Mr. Cribbins, Mr. Ambrose and a bunch of other guys from the Deputy Chief of Staff for Logistics (DCSLOG) Aviation Office looked at the ILS concept and said, "low density weapon system, less than 100 aircraft, its not worth the investment on the Army's part to put in an overhaul facility at Corpus Christi Army Depot (CCAD), to put in a training base at Training and Doctrine Command (TRADOC) to train mechanics and pilots specifically for these aircraft. Its not worth it to integrate high levels of test equipment at the unit level because of the technological insertion that they (the aircraft) were built to accept." For example, five years from now, the MFDs go away and you go to flat plate screens. So why go out and invest Army industrial funds to build up a base in DoD when you're going to scrap it in five years. You're better off to do a short term investment of, say, five million dollars in the Integrated

> Avionics Bench (IAB), you run it for five or six years, cut your (component) failures down, test it as close to the aircraft as you can get it, and that was basically the concept. . . . You let a contractor do that, and have the green suiters do their day to day maintenance. After they swap out a black box, they go back to doing the mission. [Ref. 24]

Mr. Brickner went on to state that the only problem with the LCCS concept is that not everyone involved understands the complete concept and the level of involvement required. As an example, Mr. Brickner pointed out the difference between a sustaining engineering question for a UH-60L and a MH-60K.

> If there is an engineering call, a question from a field service representative (FSR) or a logistics assistance representative (LAR), and they want to know what the repair is for a given item or what the inspection criteria is for an item. In the regular system you just see the answer. You don't see the UH-60 PM's budget with Sikorsky for sustaining engineering to answer those questions. In the case of this system, you see it all, and pay for it. Engineering support is part of the LCCS contract (because the MH-60K is not managed by PM Blackhawk, its managed by TAPO.) [Ref. 23]

d. *The PM's Perspective on Problems with the Maintenance Concept*

The PM sees very few problems with the two-level LCCS maintenance concept. A couple of minor concerns were mentioned in Major Parker's comments above. In addition to those concerns, Ms. Lorraine Lamsa, an acquisition logistician in TAPO, gave two additional areas that she feels are problems.

First, she feels that LCCS, as it is currently organized under BSAS, is too bureaucratic. She stated that since BSAS is a joint venture, and not actually part of Boeing or Sikorsky, (and remember that Boeing and Sikorsky are the prime contractors for the SOA), all formal matters dealing with either of those two organizations must be addressed through BSAS rather than with Boeing or Sikorsky directly. This simply complicates contractual and sustainment matters more than need be. [Ref. 25]

Second, she feels that it is questionable whether or not the Government is getting "good value for all of the offsite LCCS support." (By offsite, she is referring to locations other than Ft. Campbell Kentucky where the 160th SOAR(A) is located.) She stated that "a lot more money is tied up in offsite LCCS support than with onsite support (i.e. engineering support, program management, etc. . .)" She further justified her statement by claiming that "we (TAPO) only have a very fuzzy idea of what we're getting for our money." [Ref. 25]

e. The User's Perspective on Problems with the Maintenance Concept

The user sees primarily two problems arising out of the two-level LCCS maintenance concept as it is currently established. One area that was mentioned by both Major Taliento and Major Books was the belief that there is really very little, if any, AVIM peculiar maintenance on the aircraft. This being the case, they feel that there is no need for AVIM peculiar maintenance to be in the LCCS SOW. This belief is reinforced by Mr. Brickner's statement that, "when you get down to it, there is not that much AVIM peculiar maintenance" on these aircraft. Major Taliento specifically states that:

> We have the capability here in F Company to do a tremendous amount of depot level repair (and all of the AVIM repair) on these aircraft. All the IAB does for us is tell us that a black box is, in fact, broken. Not what's wrong with it. CW4 Doris (F Company's Avionics Technician) has the capability to fix "a lot of the stuff" that goes to BSAS. Just like we've done with every system that our aircraft was modified with before the MH-60K came along. I also feel that we need to move toward more self sufficiency, just like we've always had. That's been one of our strengths in the past. We could fix things that regular Army units had to evacuate through the normal supply and repair channels. [Ref. 26]

CW2 Blasey notes another problem with the two-level, LCCS maintenance concept. He states that now that BSAS is doing depot level MWOs, the units must now deal

with a fourth depot organizations applying modifications. He notes that the problem with four different depot organizations is that each one of the four applies and documents MWOs differently. Blue Grass Army Depot (BGAD) is home of the Special Operations Forces Support Activity (SOFSA). E-Systems currently has the SOFSA contract where they install major SOF peculiar MWOs and aircraft upgrades. DynCorps has the 160th SOAR(A) supplemental contract. DynCorps installs local 160th SOAR(A) MWOs. OLR has the Army wide MWO contract. OLR installs Army common MWOs. And now BSAS has the SOA LCCS contract. Among other things, BSAS is responsible for SOA peculiar MWOs. CW2 Blasey claims that this causes confusion with noncommonality of wiring diagrams, historical record updates, and other maintenance related documentation. [Ref. 21]

f. The Contractor's Perspective on Problems with the Maintenance Concept

For all intents and purposes, the contractor does not see any problem with the two-level LCCS maintenance concept.

g. The PM's Perspective on Maintenance Plan Successes and Failures

From the macro level that the PM views the maintenance plan, none of the interviewees had observed or been informed of any notable successes or failures in the actual conduct of maintenance on the aircraft. In general, according to Major Parker, actual "wrench turning" maintenance on the SOA has not been a problem. [Ref. 20]

h. The User's Perspective on Maintenance Plan Successes and Failures

The user sees things a little differently than TAPO. The primary failure with the maintenance plan, as viewed by the user, is the lack of expertise in BSAS maintenance

personnel. Following a series of incidents with BSAS maintenance personnel, Major Taliento sent a letter to the 1st Battalion, 160th SOAR(A) Battalion Commander. Attached to the letter was a 20 page document noting deficiencies in BSAS operations. Major Taliento's letter stated that:

> I would recommend that BSAS conduct an internal ARMS (Aviation Resource Management Survey) or similar type of quality assurance, quality control assessment and make changes to their operating procedures as required. To date, I have not seen anything back from BSAS or the RAMO (Regimental Aviation Maintenance Officer) stating that a corrective action has been accomplished or instituted as a result of our meeting with them. I would also suggest to the COR (Contracting Officer Representative) that he implement his contractual quality assurance checks. . . and make sure that the contractor is meeting or exceeding the requirements of the contract. . . . [Ref. 26]

Major Taliento stated that his primary concern with BSAS was trust. He was most concerned with what F Company didn't see, or hadn't caught them doing. He concluded his discussion on this topic by stating that, "at the level we're operating (National Command Authority control), and with our mission requirements ("Black" Special Operations), the maintenance piece has got to be perfect! We don't need people who don't know what's going on." [Ref. 26]

This sentiment was reflected by Major Books and CW2 Blasey as well. In general, the user does not have confidence in BSAS maintenance personnel capability, skill, and diligence. [Ref. 21]

i. The Contractor's Perspective on Maintenance Plan Successes and Failures

According to the contractor, they have not experienced any noteworthy successes or failures while actually conducting the SOA maintenance plan. They did,

however, admit to a slightly hostile working relationship with the user. Mr. Brickner attributed this relationship to a misunderstanding in work requirements between the user and BSAS. [Ref. 23]

j. The PM's Perspective on Maintenance Planning Shortfalls

The only maintenance planning shortfall identified by TAPO was that of inadequate Logistics Support Analysis (LSA) in relation to maintenance tasks. As an example of this, Major Parker discussed the Lycoming (now Allied Signal Engines), T-714 engine used on the MH-47E. He stated that the only difference between the T-714 engine and the T-712 engine (the engine used on CH-47Ds) is the Full Authority Digital Electronic Control (FADEC) system and the fuel control unit. Since these are the only differences between the two engines, it would seem logical that the user's engine mechanics could work on them. That is not the case however. Since the T-714 is classified as a peculiar item, only the LCCS contractor can work on it. Major Parker stated that this type of planning shortfall should have been caught during LSA and is now costing the Government money. [Ref. 20]

k. The User's Perspective on Maintenance Planning Shortfalls

The only maintenance planning shortfall identified by the 160th SOAR(A) was also that of inadequate LSA in relation to maintenance tasks. Not only did they concur with Major Parker's example above, but they also feel that there is no need for the LCCS contractor to conduct AVIM peculiar maintenance (if there really is such a thing.) Major Taliento and Major Books both agree that their units are capable of performing all AVIM level maintenance on the MH-60K and MH-47E. [Ref. 22 and 26]

l. The Contractor's Perspective on Maintenance Planning Shortfalls

The contractor mentioned only one maintenance planning shortfall. That shortfall was the failure to place the SOA Program in the ILS assessment file where the Logistics Evaluation Agency (LEA) (now the Army Material Systems Analysis Activity (AMSAA)) could have had insight into the program and identified potential weak areas in the ILSP. Had this occurred, many of the problems mentioned in this section, and the sections to follow, may have been alleviated through early detection and correction. [Ref. 24]

m. Maintenance Planning Analysis Summary

In general, the two-level LCCS maintenance concept is considered sound. There is very little disagreement that BSAS is critical for closed loop and peculiar item depot level maintenance, even though the AVIM Company's feel that they have the capability to perform some of the depot level black box repair in house. Organization of the current LCCS contract, and the LCCS contractor's responsibilities are questioned however. (It is important to note here that I do not feel that the LCCS concept, as established, is a true two-level maintenance organization. Rather, I submit that it is, in fact, a four-level organization. Level one is AVUM. Level two is common AVIM. Level three is peculiar AVIM. And level four is depot. This is not a streamlined maintenance structure as the ILSP would have you believe.)

With regard to the LCCS contractor's responsibilities, there appear to be numerous peculiar maintenance tasks that could be performed by user personnel. Furthermore, airframe peculiar AVIM tasks appear to be almost none existent. This seems to indicate that either a thorough LSA maintenance task analysis was not performed during ILS planning, or the level of difficulty associated with some tasks was overestimated. In either

case, it appears that another LSA maintenance task analysis should be performed in order to determine if the peculiar AVIM LCCS SOW requirement is actually necessary.

With regard to the organization of the LCCS contract, there is concern with the addition of a fourth organization capable of applying depot level MWOs. This capability appears to be redundant and arguably, not necessary. Furthermore, it complicates the performance of maintenance on the aircraft.

A final issue with the maintenance concept is the tense working relationship between the user and BSAS maintenance personnel. The user does not have confidence in the capability, expertise, and diligence of the current LCCS contractor maintenance personnel. This fact adversely affects the overall performance of the two-level LCCS maintenance concept as planned. This is not a maintenance planning issue per se, but it is an issue that must be resolved immediately.

2. Supply Support

DODI 5000.2, "Defense Acquisition Management Policies and Procedures" [Ref. 8] defines supply support as "all management actions, procedures and techniques used to determine requirements to acquire, catalog, receive, store, transfer, issue and dispose of secondary items. This includes provisioning for initial support as well as replenishment supply support." Recall from chapter three that the provisioning process was a joint effort between the Government and the prime contractors, with the Government having the final decision on coding, range, and quantity of spare parts.

The overall concept of supply support was not discussed in the SOA ILSP and will therefore be described here. In general, the supply support concept for the SOA is similar to the maintenance concept for the aircraft. It is a two part system with heavy reliance on LCCS.

Repair parts and components are categorized as common, peculiar, or closed-loop. Common items are those items which are currently used on the UH-60L and CH-47D fleet. These items are requisitioned and disposed of through the standard Army supply system. Peculiar items are those items which are not currently used on the UH-60L and CH-47D fleet. Closed-loop items are those items which are used on the UH-60L and CH-47D fleet, but have engineering directed reduced life spans because of the increased operating weights and flight environments of the MH-60K and MH-47E. Peculiar and closed-loop are requisitioned and disposed of through the LCCS contractor. In this supply support system, BSAS (the LCCS contractor) acts as the national inventory control point (NICP) and depot for all peculiar and closed-loop items.

a. The PM's Perspective on the Supply Support Concept

The PM's perspective on the supply support concept is one of necessity. Major Parker admits that, even though it is a more complex setup than most people would like, its a necessary evil given the complexity of the aircraft, the peculiar (and closed-loop) components, and the low density of aircraft. All in all, TAPO feels that the supply support concept is sound. [Ref. 20]

b. The User's Perspective on the Supply Support Concept

The user's perspective on the supply support concept is one of additional work and nonseamless interface. Major Taliento states that the two part supply support system

causes him to have to track and manage two totally independent and different supply systems. Additionally, it causes him to have to deploy with two separate repair part inventories. [Ref. 26]

CW2 Blasey reiterated the point made by Major Taliento. He stated that its simply an inconvenience to have to deal with the two independent systems. Its no longer a seamless interface with the supply system, now we have to track common items, peculiar items, and closed loop items and make sure that we're ordering them through the right system. [Ref. 21]

c. *The Contractor's Perspective on the Supply Support Concept*

The contractor's perspective on the supply support concept is one of value added. Mr. Brickner stated that the LCCS supply support concept provides the necessary NICP and depot services necessary to manage all of the peculiar and closed-loop items. He further stated that the LCCS concept, with supply support on-site, provides a much more responsive system than the user could get through the normal supply channel. Furthermore, he claimed that it is highly doubtful that the normal supply channels would accept the small quantity of peculiar and closed-loop items since there are no depot support agreements in place for the repair of those items. [Ref. 23]

Mr. Porter added to these comments by stating that the supply support concept compliments the maintenance concept. He stated that the modifications to the aircraft were designed to be Line Replaceable Units (LRUs). The concept is that the green suiter pulls out a black box, walks across the street to the LCCS supply facility, and exchanges a bad one for a good one. In actuality, its a simple reparable exchange (RX) setup. Mr. Porter further

claims that, if an Army supply sergeant walks across the street and can't get a replacement part immediately, then we (BSAS) have not done our job. [Ref. 24]

d. *The PM's Perspective on Problems with the Supply Support Concept*

In general, the PM feels that the supply support concept is a good solution to the complex problems associated with the SOA. TAPO is aware of the concerns that the user has with the concept, but they don't see an immediate solution to those concerns.

e. *The User's Perspective on Problems with the Supply Support Concept*

The user's primary concerns with the supply support concept deal with the multiple supply channels mentioned above, and the constraints placed on them by peculiar and closed-loop item requirements during deployments. Major Taliento used the MH-60K main rotor blade as an example. He stated that the MH-60K main rotor blade is a closed loop item. Therefore, "when we (1st Battalion, 160th SOAR(A)) deploy, we now have to take along a supply of regular (common) main rotor blades for the MH-60L DAP (Defensive Armed Penetrators) and the MH-60L C2 (Command and Control), as well as a supply of MH-60K main rotor blades." Major Taliento stated that the space during deployments was limited before, but now "we're at the point of having to decide what critical items we can't take on deployments." [Ref. 26]

CW2 Blasey mentioned another key point in relation to this problem. He states:

> We're doing OK maintaining the MH-60Ks <u>here</u>. But that's the key! For the past year, we've been here. When I need a spare part, I walk across the street and get one. My concern is when we start our normal deployment schedule again this summer, I think we're going to be "hurting." For example, take when we were deployed to Haiti on that aircraft carrier. Now if I need a black

> box, what am I going to do. I can't walk across the street anymore, and F Company has holes in their deployment support kits (DSKs). [Ref. 21]

He further went on to state that, even on an aircraft carrier, he could "drop a requisition" through the normal supply channels and eventually get the part. With the peculiar and closed-loop items however, he would have to rely on a make shift system of Federal Express and other shipping means to get the part. [Ref. 21]

f. The Contractor's Perspective on Problems with the Supply Support Concept

The contractor does not see any significant or noteworthy problems with the supply support concept as it is currently organized.

g. The PM's Perspective on Supply Support Successes and Failures

From the PM's perspective, the primary failure with supply support has been with replenishment of peculiar items that are common to the Air Force and/or Navy. Mr. Curtis Harold, an acquisition logistician at TAPO gave an example of a Navy managed item. He stated that there have been a couple of items that were managed by the Navy at the time of aircraft production, and the support arrangements were (supposedly) in place to support those peculiar items through the Navy system. Since that time, however, the Navy has surrendered item management responsibility to the Defense Logistics Agency (DLA). Mr. Harold claims that the problem with this situation is that DLA has coded some of the items as obsolete because they didn't know that the 160th SOAR(A) was a user of the items. [Ref. 27]

Mr. Harold went on to state that this situation has resulted in TAPO going out to the individual vendors of the supposedly obsolete items and contracting directly with them for the repair and replacement of that item. In effect, doing what DLA would have been

doing. He further claimed that BSAS could do the same thing, but that it would cost 17 to 20 percent more for them to do it. [Ref. 27]

On the positive side, however, Major Parker points out that, "even with the problems we're having in some areas of supply support, the vast majority of our mission failures have been attributable to common items." He states that this is a testament to the effectiveness of the LCCS supply support arrangement, even with its inherent complexities. [Ref. 20]

h. The User's Perspective on Supply Support Successes and Failures

The user identified two primary failures with the supply support. The first failure was noted by Major Books, Major Taliento, and CW2 Blasey. At the AVUM level, this failure is an inability to take peculiar and closed-loop items in the AVUM DSKs. CW2 Blasey stated that they don't have the "authority" to carry those items on deployments with them. What that means, as CW2 Blasey put it, is that "if I've got four MH-60Ks on 'the road' for two weeks, it takes an act of God for me to get an mission processor or multifunction display to take along as a spare. What I end up doing is relying on Federal Express to get me the parts." [Ref. 21]

At the AVIM level, this first failure manifests itself as a nonavailability of peculiar and closed-loop parts for the AVIM DSKs and "packages[1]." Major Taliento states that, "I know that we've had the 'packages' missing some MH-60K peculiar and closed-loop parts." This is seen more as an initial provisioning failure than an actual failure in supply support. However, there is no solution in sight for the foreseeable future. [Ref. 26]

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[1] "Packages" refer to the deployable parts supply that the AVIM units take on deployments.

The second failure was one of not accurately communicating the actual list of peculiar and closed-loop items and supply procedures to the actual users. CW2 Blasey provided the following example:

> Tailrotor servos are closed loop items. No body here knew that initially. So we took a UH-60L tailrotor servo, with no time on it, and installed it on an MH-60K. Fine, no problem we thought. Its the same servo - but as soon as we installed it in the MH-60K, it became a closed-loop item and we had to change the part number. This took a good tailrotor servo out of the regular supply system and added one to the closed-loop system. That caused a pretty big "stink." [Ref. 21]

Aside from these failures, however, the supply support has, for the most part, performed extremely well. Major Taliento confirmed this by stating that, "there has not been an aircraft on the flight line that has been Non-Mission Capable Supply (NMCS) for a peculiar or closed loop part." [Ref. 26]

i. The Contractor's Perspective on Supply Support Successes and Failures

The contractor identified one area as a great success in the supply support. That success is the ability to track failures in LRUs down to the subcomponent level and then to force vendors to correct identified weak components prior to replenishment. Mr. Porter uses the Integrated Avionics Subsystem as an example. He states:

> In the IAS, we've identified the weak link as the power supply. In the power supply, its predominately a failure in an R2 circuit where there is a cold solder. We just bought 50 more power supplies with improved R2 circuits in them. What makes this program different is, when I contract to buy replacement parts or replacement spares. . . I'll buy them, but we want identified reliability improvements incorporated into the parts. We won't buy the some bad parts. And most of the time, the original equipment manufacturer (OEM) has already identified the deficiency because he is the one actually doing the overhaul on the item. [Ref. 24]

Mr. Porter further claims that this system is self correcting <u>because</u> the OEM is doing the depot level repairs instead of a Government facility. "It's inherently efficient." [Ref. 24]

j. The PM's Perspective on Supply Support Planning Shortfalls

Even though supply support seems to be fairly effective, the PM commented on three areas that were lacking in supply support planning. The first planning shortfall, and potentially the most catastrophic to the program, was the intentional delay in procuring initial spares in an attempt to fund software problems. LTC Wayne Killian, the TAPO PM, stated that, "PM SOA pushed the initial spares to the right, and it looked as if the aircraft would be fielded with no spares. The only thing that saved the program from serious embarrassment was the fact that aircraft fielding was slipped to the right because of software problems." He went on to state that the fielding slip allowed the spares provisioning to catch up. This myopia was a serious shortfall in supply support planning. [Ref. 28]

The second planning shortfall was in initial spares provisioning and planning, and in spares replenishment planning. Ms. Lamsa stated that, even with the delay in fielding the aircraft, a complete provisioning package for peculiar and closed-loop parts was not in place at Ft. Campbell. She went on to say that, even after a year, "all of the initial spares are still not in place." Ms. Lamsa placed a portion of the blame for this on the slip in spares procurement and a portion of the blame on the fact that there has been at least "five or six major lists (of parts) that they have been trying to fill." [Ref. 25]

Mr. Harold concurred with these comments and also stated that, "apparently not enough forethought went into forecasting the additional requirements on replacement of closed loop items." As an example, he commented on the MH-60K main rotor spindle that

must be rebuilt during "phase" maintenance. He stated that, as of now, we (TAPO / 160th SOAR(A)) don't have enough parts to rebuild them because they were not provisioned for in the correct quantity. [Ref. 27]

The third planning shortfall was in support arrangements for Army peculiar items that are Navy and/or Air Force common items. Major Parker stated that, "when an item becomes joint use, it is supposed to be managed by DLA. That has not occurred in many cases." [Ref. 20] Mr. Harold echoed this comment by saying that support arrangements with the Navy and Air Force were never solidified. More importantly, he said, the 160th SOAR(A) was never a registered user with DLA for many of these items. Apparently, the initial spares were procured, but no plan was made for follow-on replenishment of the items. [Ref. 27]

k. The User's Perspective on Supply Support Planning Shortfalls

The user's comments on supply support planning shortfalls revolve around two of the same areas that the PM mentioned. First is the lack of support arrangements for Army peculiar parts that are Navy and/or Air Force common. Major (Promotable) Conway Ellers, the 160th SOAR(A) RAMO, stated that they were still trying to get access to some Navy and Air Force parts that are used on the MH-60K and MH-47E. He further stated that, "there are about 12 items that we don't have a Depot Support Agreement with the Navy or Air Force. Some of those items can be critical . . . and we're having problems getting them." [Ref. 29]

The second supply support planning shortfall is poor provisioning. Major Ellers gave an example of the MH-47E T-714 engine. He stated that since the engine is a peculiar item, it goes back to the manufacturer for maintenance. The problem is there were never any depot "bits and pieces" (i.e. nuts, bolts, seals, etc.) bought to support the depot at

the manufacturers facility. Major Ellers went on to say that the only thing keeping them "alive" with T-714 engines is the fact that they've got so many complete spare engines. [Ref. 29]

CW2 Blasey provided a similar example of poor provisioning and no follow-on replenishment planning. He used the MH-60K roll trim servo as an example. He stated that:

> The roll trim servo is a peculiar item. They (PM SOA) only bought 25. 23 of the 25 were installed on the original 23 aircraft. That left two for spares. We've used the two spares over the past year and they (TAPO) have never been able to reprocure them or got the bad ones fixed. [Ref. 21]

(It's important to note here that the MH-60K roll trim servo is a Navy common item used on the SH-60. Therefore, this ties back in with what TAPO and the 160th SOAR(A) RAMO commented on earlier about problems with support arrangements with the Navy and Air Force.)

l. The Contractor's Perspective on Supply Support Planning Shortfalls

The contractor identified two areas of supply support planning shortfalls. The first area was the slip in initial spares procurement. Mr. Brickner stated that, if it had not been for the delay in fielding the aircraft because of software problems, the initial spares would never have been in place to support the aircraft. He went on to say that, even with the delay, the quantity of spares that the 160th SOAR(A) wanted, and needed was not in place initially. [Ref. 23]

The second shortfall identified by the contractor was that of an inflexible contract for initial spares procurement. Mr. Brickner stated that, as the aircraft changed configuration, or someone identified a requirement for more of a given item in the "package," no mechanism was available to add those items to the initial spares buy. He further stated that

if the original provisioning list had been accurate, then a flexible contract would not have been necessary. However, given the complexity of the aircraft, the inexperience of the acquisition logisticians in PM SOA, and the poor LSA performed, it would have alleviated a lot of problems had the contractual device allowed for easy changes. [Ref. 23]

m. Supply Support Analysis Summary

In general, the supply support of the SOA is working acceptably at this time. It is important to note, however, that this acceptable level of supply support is not a result of a well written supply support section in the ILSP. The SOA ILSP failed to accurately and completely describe the supply support concept as it has actually been implemented. This failure is especially critical given the complexity of the SOA Program's supply support concept and the non-standard methods of implementing it.

Additionally, recall from DODI 5000.2, "Defense Acquisition Management Policies and Procedures" [Ref. 8] that provisioning for initial support as well as replenishment supply support is part of the definition of supply support. Also recall that the Government had the final decision on coding, range, and quantity of spare parts. This being the case, the Government, and specifically PM SOA failed to adequately provision for initial spares. Additionally they failed to adequately plan for the replenishment and sustainment of peculiar items that are Navy and/or Air Force common items. They also failed in provisioning for initial support by allowing the initial spares procurement to be slipped to the right in an attempt to solve software problems. The only reason that the SOA were fielded with adequate spares was because the entire aircraft fielding was slipped to the right after additional software problems.

Even with these serious failures, the supply support for the SOA is working remarkably well. The concept as organized allows for the accurate identification of subcomponent failure trends by BSAS and ensures that spare replenishment only occurs after acceptable solutions to component and subcomponent failures have been implemented. Additionally, thus far, no NMCS time has been attributable to closed-loop or peculiar items.

The user is still concerned with a couple of issues, however. First, is the lack of a workable solution for the support of peculiar items that are Navy and/or Air Force common. Second is the requirement to track and use two separate supply systems for repair parts. And third is the concern over peculiar and closed-loop supply procedures while deployed, given the fact that the AVUMs can't take any of these items with them, and that the AVIMs have holes in their "packages" due to poor provisioning of these items.

Given these concerns, and the level of success that supply support has enjoyed thus far, the real test for supply support will come over the next year when the units begin their "normal" deployment schedules, and the new aircraft begin to show a little "wear and tear."

It is important to note here that most of the references in the supply support analysis referred only to the MH-60K. This is due primarily to the fact that the MH-60K has been fielded longer than the MH-47E, and therefore has more data available for analysis.

3. Support Equipment

DODI 5000.2, "Defense Acquisition Management Policies and Procedures" [Ref. 8] defines support equipment as "all equipment, mobile or fixed, required to support the operation and maintenance of the system. . . ." Concentration on this ILS element is designed to ensure that all necessary Test, Measurement, and Diagnostic Equipment (TMDE), Ground

Support Equipment (GSE), Automatic Test Equipment (ATE), etc., is acquired, modified, and in position to support the weapon system when fielded. Recall from chapter three that the general plan for support equipment was to maximize the use of "standard tools and TMDE" where Built in Test (BIT) and Built in Test Equipment (BITE) were not available.

A support equipment "concept", per se, is not generally part of the ILS process or the ILSP. Therefore, the categories of "the concept" and "problems with the concept" were not analyzed in this section. Only the categories of "successes and failures" and "planning shortfalls" were analyzed.

a. The PM's Perspective on Support Equipment Successes and Failures

The PM was admittedly not aware of any specific successes or failures with regard to support equipment.

b. The User's Perspective on Support Equipment Successes and Failures

The user was quick to identify numerous failures with regard to support equipment. All of the failures identified dealt with standard UH-60L and CH-47D TMDE not being modified for SOA use prior to aircraft fielding. Staff Sergeant Ross Pederson, the senior enlisted MH-47E crewmember assigned to the Systems Integration and Maintenance Office (SIMO) of the 160th SOAR(A), gave two specific examples pertaining to the MH-47E.

Both items that Staff Sergeant Pederson discussed are critical to performing maintenance on the MH-47E. One item mentioned was the pitot static system test set and the other item was the Automatic Flight Control System (AFCS) test set. Neither one of these items had been modified to perform MH-47E peculiar tests prior to the aircraft being fielded.

Staff Sergeant Pederson stated that the only thing that saved the unit from grounding aircraft that needed the use of these items was the fact that the IAS FSR "came in, took the test sets apart, changed some stuff, and modified them to work." He further stated that, the only problem now is a lack of standard maintenance capability on the modified test sets. [Ref. 30]

Major Ellers and CW2 Blasey both discussed similar situations with MH-60K TMDE. Specifically, the critical Stability Augmentation System (SAS) / Stabilator test set was not modified prior to fielding. This piece of equipment is used on a daily basis by AVUM units and without it, aircraft requiring the test are reported as Non-Mission Capable Maintenance (NMCM). The MH-60K SAS / Stabilator test sets were modified in much the same way that the MH-47E TMDE was modified. [Ref. 21 and 29]

One final support equipment failure addressed by the user was the Automated Vibration Analysis (AVA) test set. This piece of equipment is used to conduct vibration analysis and smoothing on main rotors, tail rotors, high speed shafts, oil cooler shafts, etc. The AVA is used on all types of aircraft by changing the software "scripts" resident in its memory. Major Ellers stated that they still have not received the updated MH-60K or MH-47E scripts. Therefore, the units are still conducting vibration analysis on the aircraft using either the UH-60L script for the MH-60K or the Helitune system for the MH-47E. [Ref. 29]

c. *The Contractor's Perspective on Support Equipment Successes and Failures*

The contractor reiterated the points that the user made on support equipment failures. Primarily, the fact that many items of TMDE were not modified for SOA use prior to aircraft fielding. Mr. Brickner specifically mentioned the MH-60K SAS / Stabilator test set problem and the AVA software scripts problem. [Ref. 23]

d. The PM's Perspective on Support Equipment Planning Shortfalls

Even though the PM did not mention any specific support equipment failures or successes, it did identify two significant shortfalls in support equipment planning. Lieutenant Colonel Killian stated that the biggest support equipment shortfall was the fact that PM SOA started buying equipment too late. Furthermore, they did not accurately identify existing support equipment that needed to be modified in order to work on the MH-60K and MH-47E. He went on to state that this was probably a result of insufficient LSA in the support equipment area. [Ref. 28]

Major Parker and Ms. Lamsa both noted inadequate support equipment identification for use at the LCCS level as another support equipment planning shortfall. Major Parker stated that everyone involved would like to see a "better hot bench" (IAB) now. The current IAB only has the capability to identify whether or not a black box is good or bad. Major Parker said that "a more detailed capability, to identify down to the 'piece - part' level. . . , would alleviate good items being shipped back (to the manufacturer) for repair." [Ref. 20] Ms. Lamsa supplemented those comments with a claim that the depot at Allied Signal Engines (the T-714 engine manufacturer) "wants more test equipment" to facilitate the troubleshooting of engines. Right now, she claims, that "they're having horrendous turnaround times" on the engines and that the proper TMDE was never identified. [Ref. 25]

e. The User's Perspective on Support Equipment Planning Shortfalls

The user sees the only support equipment planning shortfall as a failure to get existing UH-60L and CH-47D TMDE modified to be useable on the MH-60K and MH-47E

prior to aircraft fielding. Other than this shortfall, the user claims that they were fielded all the peculiar SOA support equipment that they needed.

f. The Contractor's Perspective on Support Equipment Planning Shortfalls

The contractor concurred with the users identified planning shortfall, however, they also identified the lack of maintenance support and calibration for SOA support equipment as another support equipment planning shortfall.

g. Support Equipment Analysis Summary

In general, the SOA ILSP adequately covered the support equipment plan and requirements for the aircraft. This did not, however, alleviate problems with the implementation of this ILS element.

The number one problem identified in the support equipment area was the failure to modify standard UH-60L and CH-47D TMDE for use on the MH-60K and MH-47E prior to aircraft fielding. This problem, along with inadequate support equipment identification for use at the LCCS level, and the lack of maintenance support and calibration for SOA support equipment, appear to indicate inadequate LSA performance.

Another key area of concern was the late buy of support equipment noted by Lieutenant Colonel Killian. The user, however, stated that they had all of the SOA peculiar TMDE that they needed when the aircraft were fielded. This phenomenon is probably attributable to the delay in aircraft fielding (noted in the section on supply support.) The fielding delay, in all probability, allowed the late buy of SOA peculiar TMDE to be in place when the aircraft finally arrived at Ft. Campbell.

Even with these problems, the support equipment area has not been a "show-stopper" for the support of the SOA. This is due, to a large extent, to the delay in aircraft fielding and the expeditious TMDE modifications performed by the IAS FSRs. These two events allowed the support of the SOA to continue uninterrupted.

4. Technical Data

DODI 5000.2, "Defense Acquisition Management Policies and Procedures" [Ref. 8] defines technical data as "scientific or technical information recorded in any form or medium, such as manuals and drawings. . ." Recall from chapter three that the prime contractors were directed to utilize current standard aircraft manuals as the baseline for the development of SOA aircraft manuals. Additionally, all publications to support the SOA were to be commercially prepared, updated, stocked, stored, and issued by their respective prime contractors.

Although the ILS element of technical data typically encompasses more than just maintenance and operator publications, due to the NDI nature of the SOA acquisition, maintenance and operator publications are all that were addressed in the SOA ILSP. This being the case, only this aspect of technical data is analyzed here.

Also note that a technical data "concept", per se, is not generally part of the ILS process or the ILSP. Therefore, the categories of "the concept" and "problems with the concept" were not analyzed in this section. Only the categories of "successes and failures" and "planning shortfalls" were analyzed.

a. The PM's Perspective on Technical Data Successes and Failures

The PM claims that there has been only one failure with regard to the ILS element of technical data. That failure is maintenance and operator publications. This just happens to be the only portion of technical data covered in the SOA ILSP. Although every person interviewed in TAPO commented on the problems with SOA publications, they all said basically the same thing. Ms. Lamsa summed it up best when she said:

> Publications are a big problem. The customer (160th SOAR(A)) is still working with the original <u>draft</u> publications, with no changes or corrections since they were originally printed. . . . There are piles of tech changes that have never been incorporated into the publications because there is no system in place to do it. . . . I don't think that unique publications are a good idea. [Ref. 25]

b. The User's Perspective on Technical Data Successes and Failures

Inaccurate and incomplete maintenance and operator publications, as well as late delivery of these publications depict what the user has lived with since day one with the SOA. To put this in perspective, of everything that could possibly go wrong with a new weapon system fielding, CW2 Blasey said that, without a doubt, "working through and with untested and inaccurate manuals was our biggest problem." But that was only a problem <u>after</u> they got some manuals. CW2 Blasey stated that the aircraft were not fielded with any publications. He went on to say that when they finally got manuals, they only got ten sets of draft copies. Additionally, he claimed that the draft manuals "were filled with an absolutely countless number of mistakes. . . ." [Ref. 21]

Major Taliento continued the discussion of technical data failures by claiming that the maintenance publications that they have on hand now are outdated by at least 18 months. He stated that one of the biggest problem areas is with the modifications that have

been installed on the aircraft since fielding. With regard to this, he said, "there is fragmented distribution of electrical drawings, and no cross check of tail number versus configuration (i.e. level of MWOs applied.)" [Ref. 26] CW2 Blasey confirmed these comments by claiming that "this aircraft has gone through a myriad of modifications already, and there is no way the publications will ever be able to keep up with the changes." [Ref. 21]

The only issue with regard to technical data that even closely resembles a success in the user's eye is the fact that the pilots and maintainers like an integrated publication to refer to. An integrated publication replaces multiple, contractor provided, maintenance and operator manuals that were provided with all previously fielded SOF modifications. [Ref. 30]

c. *The Contractor's Perspective on Technical Data Successes and Failures*

Like the PM and the user, the contractor sees maintenance and operator publications as a major problem in the SOA Program. Apart from the fact that complete and accurate publications were not available at the time of fielding, the contractor sees the lack of a system to correct these problems as the biggest failure requiring immediate attention. Mr. Porter claims that the user is almost back to where he was in terms of having separate maintenance and operator manuals for equipment that has been added to the aircraft. As an example of that, he noted that the "Storm Scope", which had just been installed at BGAD, was not addressed in the current maintenance or operator manuals. He stated that if a pilot wants to know how to operate the thing, he's got to go get a separate manual that contains the pertinent information. The problem here is, there is currently no system in place to get the Storm Scope information into the SOA integrated operators (or maintenance) manual. [Ref. 24]

d. The PM's Perspective on Technical Data Planning Shortfalls

According to the PM, a major change in the ILSP's technical data plan late in the program seems to be the primary planning shortfall experienced in this area. The original plan was for the prime contractors to prepare, update, stock, and issue maintenance and operator publications. Somewhere along the line, this plan was changed, and a revised plan was apparently never developed to take its place. Therefore there is currently no system in place to update, revise, and correct existing manual. Ms. Lamsa concurred with this general statement and provided the following example of the problem. She stated that, if a maintenance procedure change occurs on the UH-60L, chances are, it will affect the MH-60K also, since they are the same basic airframe. The problem lies in the fact that there is no system in place now to get the procedure change from the UH-60L incorporated into the MH-60K maintenance publications. This, in fact, becomes a significant safety issue. This same basic problem is also seen in SOA peculiar procedure changes, software changes, modifications, etc. There is currently no way to get those changes incorporated into the SOA maintenance and operator manuals. [Ref. 25]

e. The User's Perspective on Technical Data Planning Shortfalls

The user identified what they considered to be two technical data planning shortfalls. The first shortfall relates to the change in the ILSP technical data plan as mentioned by the PMO. Major Ellers stated that "part of the problem" came when the initial cost estimate was given for the technical data plan outlined in the ILSP. The initial estimate was approximately three million dollars per year to update, stock, store, and issue publications. Major Ellers claims that when PM SOA received the estimate, they determined that there was

no way the program could afford it. He claims that this is the reason that the technical data plan was changed. But it does not answer the question of why the estimate surprised PM SOA so late in the program. [Ref. 29]

The second shortfall identified was inadequate time and resources to complete a thorough validation and verification (VAL/VER) of the draft publications. Staff Sergeant Pederson stated that he only had six people and one week to conduct the VAL/VER on over 20 manuals. In a statement to the obvious, Staff Sergeant Pederson said, "I think the requirement for the job (VAL/VER) was severely underestimated." [Ref. 30]

f. The Contractor's Perspective on Technical Data Planning Shortfalls

The contractor's comments on technical data planning shortfalls mimic those of the PM and user. It was very obvious to the contractor that no system was in place for maintenance and operator publication updates. Mr. Brickner emphasized that point when, he said that, "just today, CECOM (Communications, Electronics Command) finally agreed to take responsibility for the 11 series manuals." (11 series manuals are avionics manuals.) It is important to note that the date, "just today", was about a year after fielding the first aircraft. Until that agreement was reached, there was no system to update those manuals. [Ref. 23]

One of the more interesting comments about technical data planning shortfalls was made by Mr. Porter. Mr. Porter stated that:

> When I first got on the program at Boeing, I told them that we needed to brief the status of the ten ILS elements to PM SOA. I did an assessment of where the program was on each of the elements and I coded it Red / Yellow / or Green. The first time that I briefed PM SOA, when I flipped over the publications slide, and it was Red, everyone went - what do you mean we're Red? I said, publications are Red. We're three months from fielding, and you "got no books!" And you haven't run a VAL/VER yet. That's supposed to be done at least a year out! [Ref. 24]

This obviously points to a deep rooted, long term problem within PM SOA's, and arguably the prime contractors, management of technical data. Mr. Porter claims that the first time a flag was raised about maintenance and operator publications not being validated, verified, and ready was three months prior to the original fielding date. This is borderline negligence on the acquisition logisticians at both PM SOA and the prime contractors. [Ref. 24]

g. Technical Data Analysis Summary

Everyone from the PM down to the mechanic agrees that maintenance and operator publications have been, and are, a big problem with the SOA Program. Publications were not delivered on time, when they were delivered, there was not enough of them, they were in draft form, they were inaccurate, and they were incomplete.

The problem has not gotten any better with time. Currently, there is no system in place to incorporate changes and modifications to the manuals. This has resulted in mechanics performing maintenance on these sophisticated aircraft with outdated, inaccurate publications.

The ILS element of technical data was poorly managed during the program. When the ILSP's original technical data plan was altered, apparently no alternative plan was developed and/or implemented. The results of this poor management can be seen today by looking at the current state of the 160th SOAR(A)'s unsafe SOA publications.

C. MAJOR FACTORS IMPACTING THE SOA PROGRAM'S ILSP

As stated previously, the primary purpose of this chapter is to identify the "major factors" that had a significant impact on the development and implementation of the SOA Program's ILSP. This section lists, in a concise manner, the major factors that I identified

from the analysis of the SOA Program's ILSP. These major factors are broken down into two categories.

The first category is: The major factors that had a significant impact on the development of the SOA Program's ILSP. This category consists of the characteristics of the SOA Program itself that directly influenced the development of the ILSP. The items in this category are largely speculative in nature since no one from the actual ILSP development team could be located for comment. However, each items' relationship with the development of the ILSP was eluded to in one manner or another by comments from the interviewees.

The second category is: The major factors that had a significant impact on the implementation of the SOA Program's ILSP. This category consists of the characteristics of the developed ILSP and the actions or inactions of the ILS Management Team (ILSMT) that significantly influenced the implementation of the ILSP. These items were derived directly from comments made during the interviews.

1. The Major Factors That Had a Significant Impact on the Development of the SOA Program's ILSP

a. The Fact That the SOA was Designated a New Weapon System Acquisition Rather Than a Modification to the UH-60L and CH-47D

In my opinion, this item is the most significant factor listed. Prior to the MH-60K and MH-47E, the 160th SOAR(A) owned modified versions of the UH-60L and CH-47D aircraft. Even though these aircraft were designated the MH-60L and MH-47D, airframe sustainment was the responsibility of PM Blackhawk (UH-60) and PM Chinook (CH-47). Only the unique modifications to these aircraft were the responsibility of TAPO. That means that, supply support, publications support, sustaining engineering support, etc. was the

responsibility of these two PMOs and not TAPO. With the MH-60K and MH-47E however, complete aircraft sustainment became the responsibility of TAPO when PM SOA shut down.

While TAPO is manned with the best acquisition professionals in the business, it is my opinion that they are not manned to the level required to manage complete sustainment program management of two unique airframes and to continue their responsibility of developing, procuring, and sustaining modifications to all U.S. Army Special Operations Aviation aircraft. Furthermore, this arrangement is inherently inefficient because of the duplication of effort that results in three PMOs doing what should be the responsibility of two.

b. The Fact That the SOA is an Integration of Highly Complex Systems Held Together by Software

This item is one of many factors that resulted in the decision to provide maintenance and supply support with the LCCS concept.

c. The Fact That the SOA Modifications Were Designed Around LRUs and BIT / BITE Type Troubleshooting

This item is one of the main factors that resulted in the decision to utilize a "two-level" maintenance concept.

d. The Fact That Funding, Manpower, and Training Resources Were Constrained

While this item is not unique to the SOA Program, it is one of the many factors that resulted in the decision to provide maintenance and supply support with the LCCS concept. This item also resulted in some of the critical changes to the ILSP late in the Program.

e. The Apparent Fact That User Logistician Involvement Was Not Adequate

This item is one of the main factors that resulted in numerous planning shortfalls, such as poor parts provisioning, publications failures, and TMDE failures.

f. The Fact That the SOA is a Low Density Weapon System

This item is another one of the many factors that resulted in the decision to provide maintenance and supply support with the LCCS concept. Additionally, it is my opinion that the logistical consequences of this item were overlooked when the decision to establish a separate PMO was made.

g. The Fact That the SOA Program was Designated an NDI Acquisition

This item directly influenced the entire ILSP development. Since the SOA were basically modifications to existing aircraft, much of the usage data, reliability data, etc. was derived from UH-60 and CH-47 data. In my opinion, however, this fact lured PM SOA into a false sense of security believing that most of the supportability issues had already been addressed with the LSA conducted on the UH-60 and CH-47.

2. The Major Factors That Had a Significant Impact on the <u>Implementation</u> of the SOA Program's ILSP

a. The Fact That Life Cycle Contractor Support was Determined to be the Method of Maintenance and Supply Support for the SOA

This item directly influenced every aspect of maintenance and supply support in the SOA Program. It has required a cultural shift in the way of performing maintenance in the 160th SOAR(A) and, one year later, there are still mixed feelings on whether it is the right way of doing business.

b. The Fact That Supply Support for the SOA Consists of Two Separate and Independent Systems

This item has resulted in a nonseamless supply system that requires tracking and maintenance of repair parts in two separate and dissimilar systems.

c. The Apparent Fact That LSA was not Conducted to the Extent Necessary to Ensure That all ILS Elements Were Adequately Addressed

This item has affected ILS aspects throughout the ILSP. Everything from maintenance task requirement inconsistencies to support equipment shortfalls appear to have suffered due to the apparent lack of thorough LSA.

d. The Fact That the SOA Program was not Placed in the ILS Assessment File for LEA (now AMSAA) Review.

If the SOA Program had been placed in the ILS assessment file, several of the ILS planning shortfalls could have, arguably, been alleviated. Therefore, this item is at least partially responsible for many of the problems experienced in the SOA Program's ILSP implementation.

e. The Apparent Fact That the Logistics Functional Area Within PM SOA was Inadequately Prepared for the Job.

This controversial item does not apply to every individual within the PM SOA Logistics Functional Area. It applies in a general sense to the entire group over the duration of the Program. This item is also partially responsible for many of the problems experienced in the SOA Programs ILSP implementation.

f. The Fact That the SOA Fielding was Delayed

This item actually allowed many of the ILS aspects of the SOA Program to "catch up." (i.e. initial spare parts, peculiar TMDE, etc. . .)

g. The Apparent Fact That Parts Provisioning was not Adequately Performed

This item may be a result of inadequate LSA performance. Regardless, this item has resulted in shortages in the BSAS supply warehouse and the AVIM DSKs and packages.

h. The Apparent Fact That Depot Support Agreements and Replenishment Agreements Were not Established With the Navy, Air Force, and DLA for Certain Parts

This item has caused problems in getting some Navy, Air Force, and DLA managed parts repaired and replaced. In some cases, separate contracts have had to be established by TAPO in order to solve this problem. This item continues to be a major concern given the fact that parts are still being "discovered" that don't have support agreements established.

i. The Fact That the Initial Spares Buy was Delayed

This item, while a factor for consideration, ended up not causing extensive problems because the aircraft fielding was delayed. The delay in buying spares occurred prior to the decision to delay the aircraft fielding however.

j. The Apparent Fact That the Technical Data Plan was Altered Late in the Program

This item caused the critical publications problems that the 160th SOAR(A) has to this date. While all of the factors identified are important for one reason or another, this one has serious safety implications which must be solved immediately!

k. *The Apparent Fact That Existing TMDE Modifications Were Overlooked as Part of the Support Equipment Plan*

This item may be a result of inadequate LSA performance. Regardless, this item resulted in a requirement to modify existing TMDE after the SOA were already fielded. Although the modifications were done in an expeditious manner with no aircraft "down time" attributable to TMDE, the situation could have been much different.

D. CHAPTER SUMMARY

The main premise of this chapter was that interview comments made by people intimately involved with the ILS portion of an acquisition program can be used to effectively analyze a program's ILSP. And that from this analysis, major factors could be derived which significantly affect the development and implementation of that program's ILSP. Utilizing this premise, an analysis of the SOA Program's ILSP was conducted using interview comments from Technology Applications Program Office personnel, 160th Special Operations Aviation Regiment (Airborne) personnel, and Boeing / Sikorsky Aircraft Services personnel. These three groups of people are more familiar with the ILS of the SOA over the past year than anyone else in the U.S. Army.

From this analysis, 18 major factors were identified that had a significant impact on the SOA Program's ILSP. Seven of these factors were derived from the characteristics of the SOA Program itself and the influence that they had on the development of the ILSP. The other eleven factors were derived from challenges faced during implementation of the SOA Program's ILSP. Combined, these 18 major factors form the basis of the lessons learned and conclusions discussed in the next chapter.

V. LESSONS LEARNED AND CONCLUSIONS

A. INTRODUCTION

In chapter I, two primary objectives were identified for this thesis. One of the objectives was to identify and examine the major factors in the SOA Program that had a significant impact on the development and implementation of the Program's ILSP. This objective was accomplished in the previous chapter. From these major factors, the second objective of the thesis is to develop ILS related lessons learned that will benefit acquisition managers and their staffs in the effective development and implementation of ILSPs for low density NDI programs.

This chapter begins with a section that lists the ILS related lessons learned developed from the major factors identified in chapter IV. The next section presents the broad conclusions that I have drawn from this study. The final two sections answer the research questions listed in chapter I and identify possible areas for further research.

The purpose of this chapter is to draw the study together and provide the reader with logically drawn lessons learned and conclusions that other acquisition professionals might use in the development and implementation of ILSPs in low density NDI programs. This then accomplishes the second objective of the thesis.

B. LESSONS LEARNED

The lessons learned listed in this section are the result of the analysis conducted on the implementation of the SOA Program's ILSP and the related major factors identified from that analysis. A key goal in the development of these lessons learned was to keep them non-system

specific in an attempt to make them usable by as large a number of acquisition professionals as possible. It is important to reemphasize the fact that the SOA Program was a low density acquisition that consisted of numerous items of "high tech" NDI equipment integrated with software. This makes the SOA Program somewhat unique in comparison to many programs, yet I submit that even with the peculiarities of this program, many of these lessons learned are applicable to all weapon system acquisitions.

The lessons learned from the analysis of the SOA Program are:

- Unless absolutely necessary (i.e. security reasons, completely unique item, etc.) do not establish a separate Program Management Office to develop, modify or procure low density weapons systems. Sustainment of low density weapon systems, especially modified versions of existing systems (i.e. the MH-60K and MH-47E) is far more complicated and expensive through separate small Program Management Offices than it is through existing Program Management Offices.

- Integrated logistics support influence must be early, consistent, and persistent. The functional area of logistics is not "sexy", but, as discussed in chapter two, the implications of ILS related decisions account for 70 percent of the life cycle costs of a weapon system. It is high time that this importance is emphasized.

- Diverting funds away from ILS or delaying actions on ILS elements can have a devastating affect on the fielding and supportability of a weapon system. In the case of the SOA, if the aircraft fielding had not been delayed for software problems, it probably would have been delayed because of unprepared ILS elements. It is imperative that the PM safeguard ILS funds and that the Logistics Chief in the PMO be the chief proponent for safeguarding them.

- Extreme diligence is required in ILS planning regardless of whether the program is a completely new weapon system like the RAH-66 Comanche, or a modification to an existing system like the MH-60K and MH-47E. Just because a system is an NDI modification doesn't make the ILS job any easier. This point is extremely important given the fact that the vast majority of the weapon system acquisitions in the near future are going to be modifications to existing systems because of the budgetary constraints that we are operating under.

- The density of the weapon system being procured is one of the most important factors to consider when making key ILS decisions. This point is not mentioned in the current literature on ILS in NDI systems. Using contractor versus organic

support as an example, in general, if the weapon system is low density, favor contractor support. If the weapon system is high density, favor organic support.

- No two acquisitions are the same, and no two ILSPs are the same. Every situation has its own unique requirements. It is imperative that acquisition logisticians remain flexible, innovative, and in touch with what the user needs and wants to support a new system. If the support system does not meet the needs of the user, if it is not "user" friendly, if it is not flexible enough, etc., then the acquisition logistician has failed at his / her job.

- Logistical support analysis (LSA) tailoring, use, thoroughness, detail, etc. is critical to establishing and implementing successful ILS in weapon systems. Supportability success or failure depends on the diligence with which the LSA tasks are selected and accomplished.

- If you are going to use the concept of Life Cycle Contractor Support (LCCS) for a weapon system, ensure that the mechanics, technicians, supply personnel, and managers to be hired are qualified to perform the job before awarding the contract. Additionally, ensure that key people know what they are getting for the money spent before awarding the contract. This seems like common sense, but apparently it is not. It all boils down to a clear, concise, well thought out and written Statement of Work (SOW).

- The right amount of user involvement and interface with the PM is key to the success of a program. Not only operator involvement, but also maintainer involvement. A word of caution however. User involvement in a program can become a detriment if the PM allows the user to become involved to the point where they are "calling the shots." The PM is ultimately responsible for enforcing the "good idea cut off" window, and for conducting the cost benefit analysis of additional "goodies." (Sometimes that extra million dollars just isn't worth the one knot difference in top end airspeed. The PM has got to make the call.)

- It is imperative that everyone involved in a unique supportability arrangement understand the concept, or intent, behind that arrangement. Without an understanding of the concept, the maintainers are like an infantry battalion going into battle without knowing the brigade commander's intent. Everything is great while its going according to plan, but sooner or later, things are going to start going wrong, and that's when everyone needs to know what and how things are really suppose to happen and what that end result is suppose to be.

- Thoroughness in the planning, preparation and updating of the ILSP is critical to successful ILS in a weapon system. Failure to have a good plan that is continually updated during the life of the program is destined to result in mediocre ILS for the system.

- Acquisition logisticians must have a different mind set when dealing with a completely nonstandard support concept and ILSP. They must thoroughly understand the user and his requirements, as well as the implications of their decisions on the user's ability to support the weapon system in the field.

- Oversight is not necessarily a "bad thing." Involvement with the Army Material Systems Analysis Agency (AMSAA) may be able to alleviate some problems that would otherwise be incurred.

- Contractor versus organic support is one of the major decisions that must be made early in a program. Once the decision is made, the concept to support the decision must be exhaustively defined, codified, refined, and established. Too many other ILS decisions hinge on this decision to delay it. Vacillation on this decision is just as harmful and potentially more expensive than no decision at all.

- If LCCS is determined to be the support concept for a weapon system, it is absolutely critical to the success of the support of that system that a proactive and knowledgeable Quality Assurance Representative (QAR) and Contracting Officer's Representative (COR) be assigned to ensure its proper execution.

- Never, unless absolutely forced to, buy any peculiar item for a low density acquisition program. Modify, adapt, integrate, etc. existing items that have a support structure already in place. The time, effort, and expense required to establish a support base for low density peculiar items is prohibitively expensive.

- Multiple maintenance contractors working in and for the same organization is not a wise decision. Inevitably comparisons, favoritism, and animosity build up, thereby reducing the effectiveness of everyone involved. If multiple contractors are determined to be a preferred option, attempt to consolidate "like" tasks under single contracts so there is no overlap between contractors.

- When using multiple sources of supply for repair parts (i.e. Army, Navy, Air Force, DLA) ensure that the user is a "registered user" of the system and that the required support and replenishment agreements are in place for the life of the system.

- Strong, experienced acquisition logisticians are mandatory in complex NDI weapon system acquisitions. This is especially true in low density NDI programs.

- Complex maintenance and supply concepts invite "challenges" for the user. Whenever possible, apply the adage of "KISS" - keep it simple (for the) soldier.

C. CONCLUSIONS

1. ILS in NDI Programs

Four general conclusions can be drawn from this thesis with respect to ILS in NDI programs. First, planning and implementation of ILS in NDI programs can, and does, pose a challenge to the acquisition logistician and the PM community as a whole. This statement is not a real revelation in and of itself until you compare what current DoD literature claims to be the challenging areas of ILS in NDI to that which this study found to be the major challenging factors in the SOA Program.

The publication SD-2, "Buying NDI" [Ref. 12] states that "shortened schedules, technology driven configuration changes, and greatly extended service life all contribute to the challenge of NDI support." The Defense Systems Management College publication, "NDI Acquisition, an Alternative to 'Business as Usual,'" [Ref. 4] claims that the compressed acquisition life cycle and the rapidly evolving nature of NDI hardware and software make ILS in NDI acquisitions significantly more difficult to manage. I submit that, while these statements may be true in some NDI programs (i.e. commercial of the shelf (COTS) type acquisitions), they are not true in all NDI programs. The SOA Program, which was not a COTS program, did not suffer from any of these "challenging" areas.

This establishes the basis for my second general ILS conclusion. The current DoD literature that addresses ILS in NDI programs concentrates too heavily on COTS type acquisitions, and not on NDI acquisitions as a whole. Remember from chapter II that the Army breaks it's definition of NDI down into three distinct categories: (1) off-the-shelf or basic NDI; (2) NDI adaptation; and (3) NDI integration. The challenges facing ILS

development in each of these three NDI categories is different. Current DoD literature does not effectively address these differences.

The third general ILS conclusion that I drew from this thesis is that the relative density of a weapon system procurement is as important a consideration for ILS development as being an NDI acquisition is. Low density (low quantity) acquisitions, such as the SOA, require numerous unique supportability considerations. To the best of my knowledge, ILS considerations for low density weapon systems is not addressed in any DoD literature.

The fourth and final general ILS conclusion drawn from this thesis is a restatement of a well known fact. The key to successful ILS planning and implementation is people. Tenacity and diligence in the ILS planning and implementation process by people who are qualified, innovative, motivated, and sensitive to the user's real needs will result in the successful ILS of new weapon systems.

2. ILS in Low Density Weapon System Programs

Two general conclusions can be drawn from this thesis with respect to ILS in low density weapon system programs. First, as stated above, there is a critical shortage of DoD literature available on ILS considerations for low density weapon systems. I believe that this thesis has shown that unique ILS considerations do exist in low density weapon system acquisitions and therefore should be addressed accordingly.

Second, never, unless absolutely necessary, (i.e. security reasons, completely unique item, etc.) establish a separate Program Management Office to develop, modify or procure low density weapons systems. This is a reiteration of one of the major factors identified in chapter IV and one of the lessons learned listed in this chapter. Had the SOA Program been

established as a modification program under PM Blackhawk or PM Chinook (much like the UH-60Q Medevac Helicopter or the VH-60L VIP Helicopter), many of the sustainment problems and expenses that the SOA Program faced, and is currently facing, could have been eliminated. As an example, expenses such as sustaining engineering (mentioned in chapter IV) could be spread over a much higher number of aircraft, thus reducing the per unit cost of such expenses. Sustainment of low density weapon systems, especially modified versions of existing systems (i.e. the MH-60K and MH-47E) is far more complicated and expensive through separate small Program Management Offices than sustainment through an existing Program Management Office.

3. ILS in the Special Operations Aircraft Program

Two general conclusions can be drawn from this thesis with respect to ILS in the SOA Program. First, the ILSP for the SOA Program was only adequately developed and implemented. The numerous ILS planning shortfalls noted in the analysis portion of chapter IV were only overcome by the fact that the aircraft was delayed in fielding. As mentioned in the lessons learned of this chapter, chances are that the SOA fielding would have been delayed for insufficient ILS even if it had not been experiencing the software problems that actually caused its fielding delay. This apparent fact leads to this conclusion.

Second, the current support of the SOA is going exceptionally well, especially given the obstacles that the user had to overcome when the aircraft was first fielded. This current success in support of the aircraft is attributed to numerous factors. First and foremost, it is attributable to the experience, dedication, and tenacity of the soldiers of the 160th Special Operations Aviation Regiment (Airborne) (SOAR(A)). These men possess skills and abilities

not found in any other aviation organization in the U.S. Army. Second, it is attributable to the fact that the aircraft are still relatively new. And third, it is at least partially attributable to the maintenance and supply concept in place to support the aircraft. The concept itself is fairly sound, it was the detailed planning and execution that caused the problems with ILS.

D. ANSWERS TO THE RESEARCH QUESTIONS

This section provides summarized answers to the questions which guided this research.

1. Primary Research Question

The primary research question for this thesis is: **What major factors in the SOA Program had a significant impact on the development and implementation of the Program's ILSP and what lessons can be learned from those factors?**

The following major factors were identified in chapter IV as having a significant impact on the development of the SOA Program's ILSP:

- The fact that the SOA was designated a new weapon system acquisition rather than a modification to the UH-60L and CH-47D.
- The fact that the SOA is an integration of highly complex systems held together by software.
- The fact that the SOA modifications were designed around LRUs and BIT / BITE type troubleshooting.
- The fact that funding, manpower, and training resources were constrained.
- The apparent fact that user logistician involvement was not adequate.
- The fact that the SOA is a low density weapon system.
- The fact that the SOA Program was designated an NDI acquisition.

The following major factors were identified in chapter IV as having a significant impact on the implementation of the SOA Program's ILSP:

- The fact that LCCS was determined to be the method of maintenance and supply support for the SOA.

- The fact that supply support for the SOA consists of two separate and independent systems.

- The apparent fact that LSA was not conducted to the extent necessary to ensure that all ILS elements were adequately addressed.

- The fact that the SOA Program was not placed in the ILS assessment file for LEA (now AMSAA) review.

- The apparent fact that the logistics functional area within PM SOA was inadequately prepared for the job.

- The fact that the SOA fielding was delayed.

- The apparent fact that parts provisioning was not adequately performed.

- The apparent fact that depot support agreements and replenishment agreements were not established with the Navy, Air Force, and DLA for certain parts.

- The fact that the initial spares buy was delayed.

- The apparent fact that the technical data plan was altered late in the program.

- The apparent fact that existing TMDE modifications were overlooked as part of the support equipment plan.

The following lessons learned were identified at the beginning of this chapter:

- Sustainment of low density weapon systems, especially modified versions of existing systems (i.e. the MH-60K and MH-47E) is far more complicated and expensive through separate small Program Management Offices than it is through existing Program Management Offices.

- Integrated logistics support influence must be early, consistent, and persistent.

- Diverting funds away from ILS or delaying actions on ILS elements can have a devastating affect on the fielding and supportability of a weapon system.

- Extreme diligence is required in ILS planning regardless of whether the program is a completely new weapon system or a modification to an existing system.

- The density of the weapon system being procured is one of the most important factors to consider when making key ILS decisions.

- It is imperative that acquisition logisticians remain flexible, innovative, and in touch with what the user needs and wants to support a new system.

- Logistical support analysis (LSA) tailoring, use, thoroughness, detail, etc. is critical to establishing and implementing successful ILS in weapon systems.

- If you are going to use the concept of Life Cycle Contractor Support (LCCS) for a weapon system, ensure that the mechanics, technicians, supply personnel, and managers to be hired are qualified to perform the job before awarding the contract.

- The right amount of user involvement and interface with the PM is key to the success of a program.

- It is imperative that everyone involved in a unique supportability arrangement understand the concept, or intent, behind that arrangement.

- Thoroughness in the planning, preparation and updating of the ILSP is critical to successful ILS in a weapon system.

- Acquisition logisticians must have a different mind set when dealing with a completely nonstandard support concept and ILSP.

- Oversight is not necessarily a "bad thing."

- Contractor versus organic support is one of the major decisions that must be made early in a program.

- If LCCS is determined to be the support concept for a weapon system, it is absolutely critical to the success of the support of that system that a proactive and knowledgeable Quality Assurance Representative (QAR) and Contracting Officer's Representative (COR) be assigned to ensure its proper execution.

- Never, unless absolutely forced to, buy any peculiar item for a low density acquisition program.

- Multiple maintenance contractors working in and for the same organization is not a wise decision.

- When using multiple sources of supply for repair parts (i.e. Army, Navy, Air Force, DLA) ensure that the user is a "registered user" of the system and that the required support and replenishment agreements are in place for the life of the system.

- Strong, experienced acquisition logisticians are mandatory in complex NDI weapon system acquisitions. This is especially true in low density NDI programs.

- Complex maintenance and supply concepts invite "challenges" for the user.

2. Subsidiary Research Questions

a. What is integrated logistics support; what is nondevelopmental item acquisition; and, how does integrated logistics support differ in nondevelopmental item acquisitions?

Integrated logistics support is:

a disciplined, unified and iterative approach to the management and technical activities necessary to:

1. Develop support requirements that are related consistently to readiness objectives, to design, and to each other;
2. Integrate support considerations effectively into the system and equipment design;
3. Identify the most cost-effective approach to supporting the system when it is fielded; and
4. Ensure that the required support structure elements are developed and acquired. [Ref. 8]

Nondevelopmental item acquisition is generally considered the acquisition of any of the following items:

- Any item available in the commercial marketplace.

- Any previously developed item in use by the U.S. Government or cooperating foreign governments.

- Any item of supply needing only minor modifications to meet DoD requirements.

The Army breaks these items down into the following specific categories:

- Off-the-shelf or basic NDI -- used in the same environment for which items were designed and no development or modification is required.
- NDI adaptation -- products needing adaptation for use in an environment different from that for which they were designed.
- NDI integration -- integrating NDI components and subsystems.

ILS in NDI acquisitions differs from ILS in developmental acquisitions primarily due to the significantly more difficult challenges that acquisition personnel must face. Some of the challenges that acquisition personnel must face in ILS for NDI systems include:

- The compressed acquisition life-cycle.
- The rapidly evolving nature of NDI hardware and software.
- The limited ability of the developing agency to influence the system design.
- The debate over contractor versus organic support.
- The determination of responsibility for sustaining program management.

This all boils down to one thing: there is not an "ideal" or "text book" solution to support for NDIs. Acquisition personnel must understand that implementing effective ILS for NDI will require a departure from the "normal" procedures of a developmental item acquisition. As long as the unique requirements and concerns of each NDI program are recognized and considered, effective ILS can be achieved for the life of an NDI.

b. What is the Special Operations Aircraft Program, and to what extent are the aircraft in this program modified over regular Army aircraft?

The SOAProgram is an initiative by Headquarters, Department of the Army, in response to the Department of Defense Special Operations Forces Airlift Report and the

Special Operations Forces Expedited Essential Required Operational Capability, to provide aircraft capable of performing clandestine, deep penetration airlift missions in adverse weather with limited lighting and visibility during night or day conditions over all types of terrain.

The SOA Program entailed the design, integration, modification, and qualification of a Mission Equipment Package (MEP) to enhance the operational capability of the UH-60L and CH-47D. The MEP included: (1) an Integrated Avionics Subsystem to enhance the communications and navigation capability of the aircraft; (2) an improved Aircraft Survivability Equipment suite; (3) more powerful armament; (4) the addition of external and internal fuel tanks and air-to-air refueling provisions; (5) upgraded transmissions (MH-60K only); and (6) upgraded engines (MH-47E only).

c. *What are the specifics of the Special Operations Aircraft Program's Integrated Logistics Support Plan?*

See section C, part two of chapter III in this thesis for the specific details of the SOA Program's ILSP. In brief, the most important aspect of the Program's ILSP was the direction provided to pursue a two level life cycle contractor support concept for the maintenance and supply of the aircraft. This decision effectively influenced every aspect of ILS for the aircraft from reliability, availability, and maintainability objectives to support resource funding. The SOA Program's ILSP is a good example of unique requirements and concerns being recognized and considered in the development of a support plan.

d. *Has the Special Operations Aircraft Program's Integrated Logistics Support Plan been successfully implemented?*

The ILSP for the SOA Program was successfully implemented. However, this is a qualified statement. First, the numerous ILS planning shortfalls noted in the analysis

portion of chapter IV were only overcome by the fact that the aircraft was delayed in fielding. As mentioned in the lessons learned of this chapter, chances are the SOA fielding would have been delayed for insufficient ILS if it had not been for the software problems that actually caused its fielding delay.

Second, while the current support of the SOA is going well, this is attributed to numerous factors other than an exceptional ILSP. The most important factor attributing to the current success is the experience, dedication, and tenacity of the soldiers of the 160th SOAR(A). It is my sincere belief that a regular aviation unit would not have been able to successfully support the SOA up to this point. The other key factor attributing to the current success is the fact that the aircraft are still relatively new.

e. What factors were identified as critical during the development and implementation of the Special Operations Aircraft Program's Integrated Logistics Support Plan?

The major factors identified as having a significant impact on the development and implementation of the SOA Program's ILSP are listed in section C of chapter IV and section D, part one of this chapter. I consider the following factors as the most critical in the development and implementation of the SOA Program's ILSP.

(1) Critical Development Factors:

- The fact that the SOA was designated a new weapon system acquisition rather than a modification to the UH-60L and CH-47D.
- The fact that the SOA is a low density weapon system.

(2) Critical Implementation Factors:

- The fact that LCCS was determined to be the method of maintenance and supply support for the SOA.

- The fact that supply support for the SOA consists of two separate and independent systems.

- The apparent fact that LSA was not conducted to the extent necessary to ensure that all ILS elements were adequately addressed.

- The apparent fact that the logistics functional area within PM SOA was inadequately prepared for the job.

f. ***What Integrated Logistics Support related lessons learned can be gained from the Special Operations Aircraft Program?***

The ILS related lessons learned from the SOA Program are listed in section B of this chapter and part one of section D in this chapter. I consider the following lessons learned as the most relevant to a broad range of Programs Managers:

- Sustainment of low density weapon systems, especially modified versions of existing systems (i.e. the MH-60K and MH-47E) is far more complicated and expensive through separate small Program Management Offices than it is through existing Program Management Offices.

- The density of the weapon system being procured is one of the most important factors to consider when making key ILS decisions.

- Logistical Support Analysis (LSA) tailoring, use, thoroughness, detail, etc. is critical to establishing and implementing successful ILS in weapon systems.

- It is imperative that everyone involved in a unique supportability arrangement understand the concept, or intent, behind that arrangement.

- Acquisition logisticians must have a different mind set when dealing with a completely nonstandard support concept and ILSP.

- Contractor versus organic support is one of the major decisions that must be made early in a program.

- Never, unless absolutely forced to, buy any peculiar item for a low density acquisition program.

- Strong, experienced acquisition logisticians are mandatory in complex NDI weapon system acquisitions. This is especially true in low density NDI programs.

E. AREAS FOR FURTHER RESEARCH

As a result of this study, I have identified the following areas for consideration of further research. These areas are broken down into quantitative areas, qualitative areas, and "combination" areas.

1. Quantitative Areas for Further Research

a. Cost Analysis of Low Density Weapon System Support Through an Existing Program Management Office Versus Support Through a New, Separate Program Management Office

Research in this area could explore the theoretical cost difference between development and support of the SOA Program by the Blackhawk PM (or Chinook PM) versus development of the aircraft by the SOA PMO and support of the aircraft by the Technology Applications Program Office (TAPO).

b. Life Cycle Cost Comparison of an all Organic Maintenance Concept to a Life Cycle Contractor Support Maintenance Concept

Research in this area could consist of a theoretical comparison of the life cycle cost differences in the SOA Program under the current LCCS concept versus an all organic maintenance concept. A twist on this approach could be to conduct a cost analysis on various hybrids of these concepts and make a recommendation for a give support concept.

2. Qualitative Areas for Further Research

a. Development of Specific Integrated Logistics Support Considerations in Low Density Weapon System Acquisitions

Research in this area could survey a large number of low density weapon system programs and establish a list of considerations that PM personnel in these programs

feel impacted their programs. This could be integrated into a proposed change or addition to current literature on ILS and submitted to the Defense Systems Management College.

b. A Case Study on the Integrated Logistics Support Planning Thus Far in a Current Major Weapon System Acquisition

Research in this area could explore the ILS planning considerations thus far in a major weapon system such as the RAH-66 Comanche Program or the Joint Advanced Strike Technology Aircraft Program. A twist on this would be to conduct a analysis of the ILS planning conducted on a program that has had sustainment problems, such as the AH-64 Apache, and compare it to a current program such as the RAH-66 Comanche.

3. Combination Areas for Further Research

a. A Detailed Study on How Many Acquisition Programs Have Had Integrated Logistics Support Delays and the Common Effects of Those Delays

Research in this area could survey a large number of acquisition programs to determine how many of them experienced delays in one or more ILS elements (i.e. delay in initial spares procurement, etc. . .) The research could continue on to determine the common effects of those delays and the reasons for them. An alternative to this would be to choose one or two elements and perform a detailed analysis of the cost of the delays in those element(s).

b. An Analysis of the Market Investigation / Analysis Performed Prior to a Recent, Major Nondevelopmental Item Acquisition

Research in this area could analyze the market investigation / analysis performed on a recent, major, successful NDI acquisition such as the Army's "New Training Helicopter." This analysis could culminate in a list of lessons learned from this analysis.

F. A FINAL THOUGHT

ILS development and implementation for any acquisition program is a challenging and frustrating job. Developing and implementing responsive, cost effective ILS in other than the "typical" text book developmental program can challenge the PM and his logisticians beyond anything that they've been trained to handle.

The SOA Program is one such program that challenged the entire PMO. This thesis analyzed the challenges faced by the SOA PMO during the implementation of their ILSP. In order to put the "major factors" and lessons learned listed in this thesis into perspective, it is important to state two critical items which must be considered when looking at these results.

First, at the time that I conducted the interviews used in this thesis, the SOA had only been in the field for about one year. Because of this, the support for these aircraft should still be considered in the infancy stage. The support structure is experiencing the same growing pains that every new weapon system experiences when first fielded. It would be wrong to expect any new weapon system to be fielded with no supportability problems.

Even considering this first item, the SOA Program experienced some serious ILS development and implementation problems which it should not have. That brings me to the second item that must be considered by the readers of this thesis. The 160th SOAR(A) is not the typical Army organization. The organization has 15 years of experience dealing with nonstandard equipment and maintenance procedures. This fact allowed the SOA to be fielded with a "less than perfect" ILSP and to overcome all of the challenges mentioned in this thesis.

Fielding a new, highly complex weapon system, with a nonstandard support arrangement to an organization that does not have experience dealing with this type of

arrangement may encounter more challenges than this thesis has brought to light. Program managers and acquisition logisticians must consider this when looking at the "major factors" and lessons learned identified here.

APPENDIX A. ACRONYM LIST

The following is a consolidated list of acronyms found throughout this thesis:

ACAT	Acquisition Category
ADF	Automatic Direction Finder
AFCS	Automatic Flight Control System
AHRS	Attitude Heading Reference System
AM	Amplitude Modulating
AMC	Army Material Command
AMSAA	Army Material Systems Analysis Activity
ANVIS	Aviator Night Vision Imaging System
Ao	Operational Availability
APM	Assistant Program Manager
AR	Army Regulation or Aerial Refueling
ARMS	Aviation Resource Management Survey
ASE	Aircraft Survivability Equipment
ATCOM	Aviation Troop Command
ATE	Automatic Test Equipment
ATHS	Air Target Handover System
AVA	Automatic Vibration Analysis
AVIM	Aviation Intermediate Maintenance
AVSCOM	Aviation Systems Command

AVUM	Aviation Unit Maintenance
BGAD	Blue Grass Army Depot
BHC	Boeing Helicopter Company
BIT	Built in Test
BITE	Built in Test Equipment
BSAS	Boeing / Sikorsky Aircraft Services
CALS	Continuous Acquisition and Life Cycle Support
CCAD	Corpus Christi Army Depot
CCSS	Commodity Command Standard System
CDU	Control Display Unit
CECOM	Communications Electronics Command
CED	Concept Exploration and Definition
CH	Cargo Helicopter
CLS	Contractor Logistics Support
CMS	Cockpit Management System and Combat Mission Simulator
COR	Contracting Officer Representative
COTS	Commercial Off the Shelf
CRLCMP	Computer Resource Life Cycle Management Plan
CRMP	Computer Resource Management Plan
CW	Continuous Wave
CWO	Chief Warrant Officer
C2	Command and Control

DA	Department of the Army
DA PAM	Department of the Army Pamphlet
DAP	Defensive Armed Penetrator
DCSLOG	Deputy Chief of Staff for Logistics
DEMVAL	Demonstration and Validation
DLA	Defense Logistics Agency
DLSIE	Defense Logistics Studies Information Exchange
DMMH/FH	Direct Maintenance Man Hours per Flight Hour
DoD	Department of Defense
DoDD	Department of Defense Directive
DoDI	Department of Defense Instruction
DP	Display Processor
DSK	Deployment Support Kit
DSMC	Defense Systems Management College
DTIC	Defense Technology Information Center
ELT	Emergency Locator Transmitter
EMD	Engineering and Manufacturing Development
ETS	External Tank Support
F	Fahrenheit
FADEC	Full Authority Digital Engine Control
FAR	Federal Acquisition Regulation
FASA	Federal Acquisition Streamlining Act

FH	Flight Hour
FLIR	Forward Looking Infra-Red
FM	Frequency Modulating
FMC	Fully Mission Capable
FMS	Foreign Military Sales
FOT&E	Follow On Test and Evaluation
FRIES	Fast Rope Insertion Extraction System
FSR	Field Service Representative
FY	Fiscal Year
GE	General Electric
GPS	Global Positioning System
GS	Glide Slope
GSE	Ground Support Equipment
HF	High Frequency
IAB	Integrated Avionics Bench
IAS	Integrated Avionics Subsystem
IBM	International Business Machine
IBU	Interference Blanker Unit
IFF	Identification Friend or Foe
IGCE	Independent Government Cost Estimate
IKPT	Instructor and Key Personnel Training
ILS	Integrated Logistics Support and Instrument Landing System

ILSMT	Integrated Logistics Support Management Team
ILSP	Integrated Logistics Support Plan
INU	Inertial Navigation Unit
ISSA	Interservice Supply Support Agreements
ISP	Integrated Support Plan
ITS	Integrated Training System
JAST	Joint Advanced Strike Technology
KHZ	Kilo Hertz
LAR	Logistics Assistance Representative
LCC	Life Cycle Cost
LCCS	Life Cycle Contractor Support
LEA	Logistics Evaluation Activity
LOC	Localizer
LRU	Line Replaceable Unit
LSA	Logistics Support Analysis
LSAR	Logistics Support Analysis Record
LSB	Lower Side Band
MAC	Maintenance Allocation Chart
MANPRINT	Manpower and Personnel Integration
MB	Marker Beacon
MC	Mission Capable
MDG	Map Display Generator

MEA	Maintenance Engineering Analysis
MEP	Mission Equipment Package
MFD	Multifunction Display
MFP	Material Fielding Plan
MH	Modified Helicopter
MHZ	Mega Hertz
MIL-STD	Military Standard
MMR	Multmode Radar
MNS	Mission Need Statement
MOS	Military Operational Specialties
MP	Mission Processor
MSL	Mean Sea Level
MTBEMA	Mean Time Between Essential Maintenance Actions
MTBMA	Mean Time Between Mission Abort
MTTR	Mean Time To Repair
MWO	Modification Work Order
MWS	Missile Warning Set
NCA	National Command Authority
NDB	Nondirectional Beacon
NDI	Nondevelopmental Item
NET	New Equipment Training
NICP	National Inventory Control Point

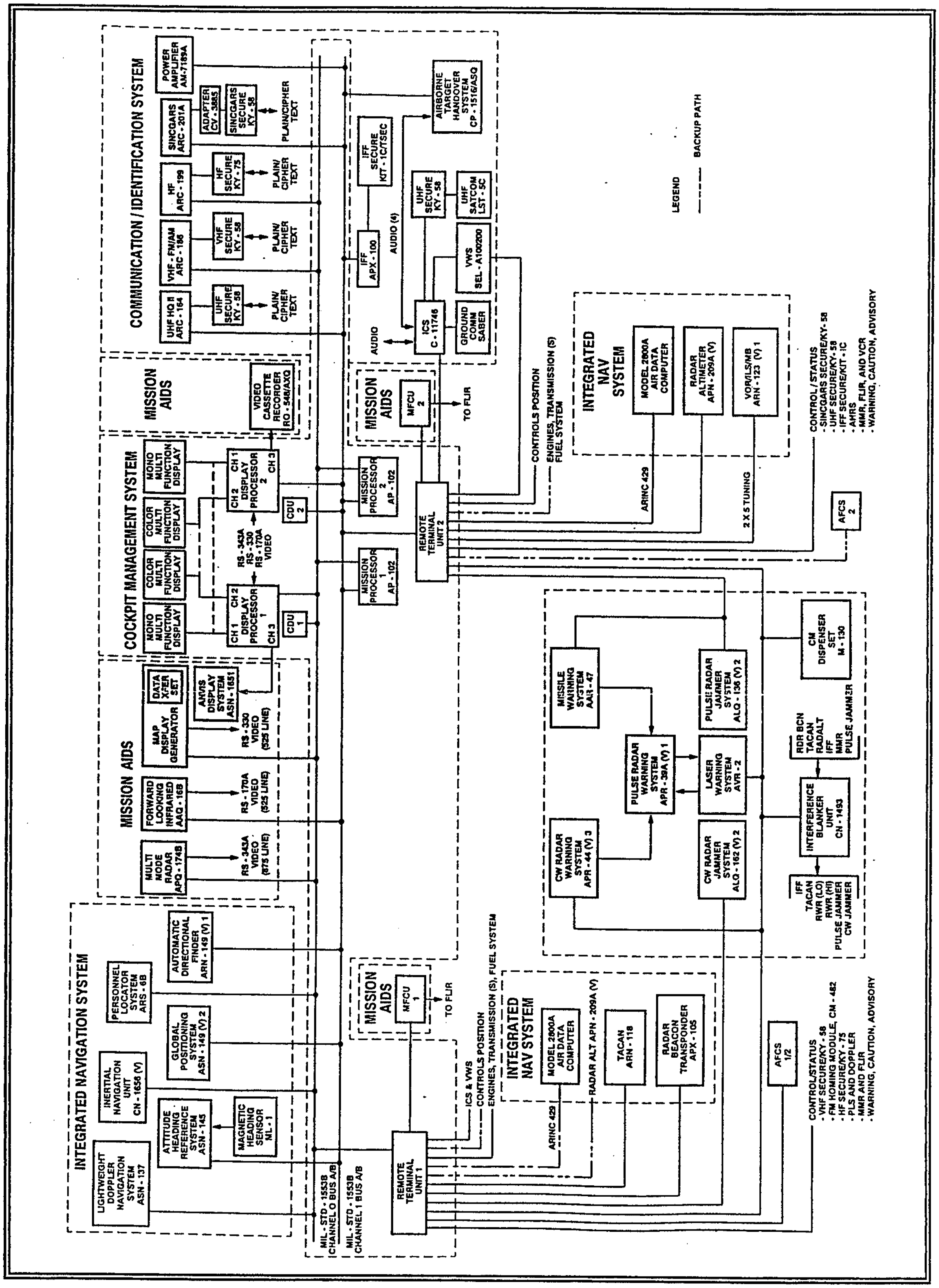
NM	Nautical Mile
NMC	Non Mission Capable
NMCM	Non Mission Capable Maintenance
NMCS	Non Mission Capable Supply
OEM	Original Equipment Manufacturer
OGE	Out of Ground Effect
OMS	Operator, Maintainer, and Support
ORD	Operational Requirements Document
O&M	Operations and Maintenance
O&O	Operational and Organizational
PAE	Preliminary Airworthiness Evaluation
PDSS	Post Deployment Software Support
PEO	Program Executive Office
PGSE	Peculiar Ground Support Equipment
PIDS	Prime Item Development Specification
PHS	Packaging, Handling, and Storage
PHS&T	Packaging, Handling, Storage, and Transportation
PLS	Personnel Locator System
PM	Program Manager
PMC	Partially Mission Capable
PMO	Program Management Office
PMR	Provisioning Master Record

POI	Program of Instruction
POM	Program Objective Memorandum
PPS	Post Production Support
PPSP	Post Production Support Plan
PTT	Part Task Trainer
QAR	Quality Assurance Representative
RAH	Reconnaissance / Attack Helicopter
RAM	Reliability, Availability, and Maintainability
RAMO	Regiment Aviation Maintenance Officer
ROC	Required Operational Capability
RTU	Remote Terminal Unit
RX	Reparable Exchange
R&D	Research and Development
R&M	Reliability and Maintainability
SA	Sikorsky Aircraft
SAS	Stability Augmentation System
SATCOM	Satellite Communication
SE	Support Equipment
SIMO	Systems Integration and Management Office
SINCGARS	Single Channel Ground and Airborne Radio System
SOA	Special Operations Aircraft
SOAR(A)	Special Operations Aviation Regiment (Airborne)

SOF	Special Operations Forces
SOFSA	Special Operations Forces Support Activity
SOW	Statement of Work
SRO	System Readiness Objective
S&I	Standardization and Interoperability
TA	Terrain Avoidance
TAPO	Technology Applications Program Office
TDS	Training Device System
TEMP	Test and Evaluation Master Plan
TF	Terrain Following
TM	Technical Manual
TMDE	Test, Measurement, and Diagnostic Equipment
TPS	Test Program Sets
TRADOC	Training and Doctrine Command
TT	Technical Test
T&E	Test and Evaluation
UH	Utility Helicopter
UHF	Ultra High Frequency
USB	Upper Side Band
USSOCOM	United States Special Operations Command
VAL/VER	Validation / Verification
VHF	Very High Frequency

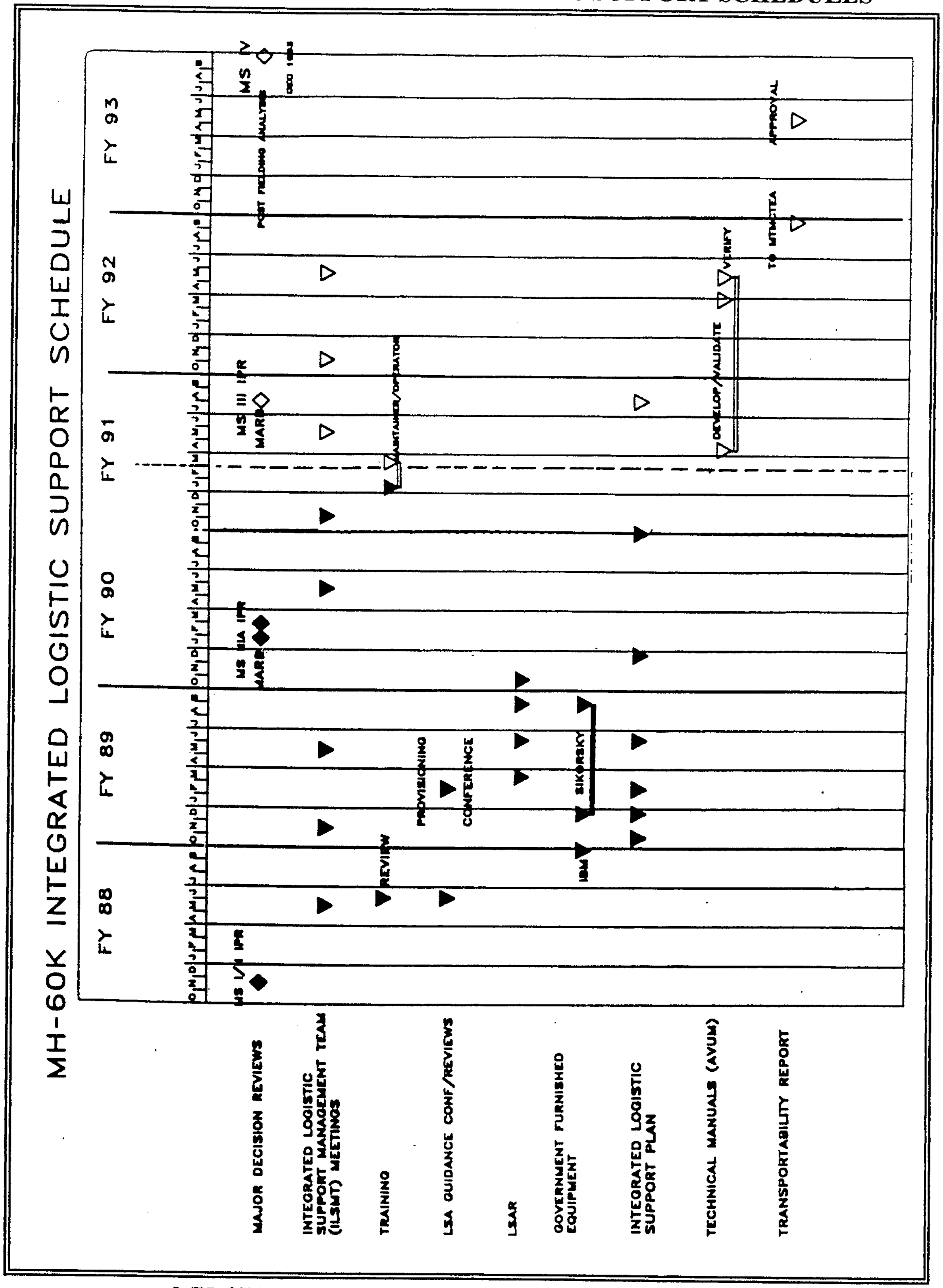
VIP	Very Important Person
VOR	VHF Omnidirectional Radio
WBS	Work Breakdown Structure

APPENDIX B. DETAILED IAS WIRING DIAGRAM

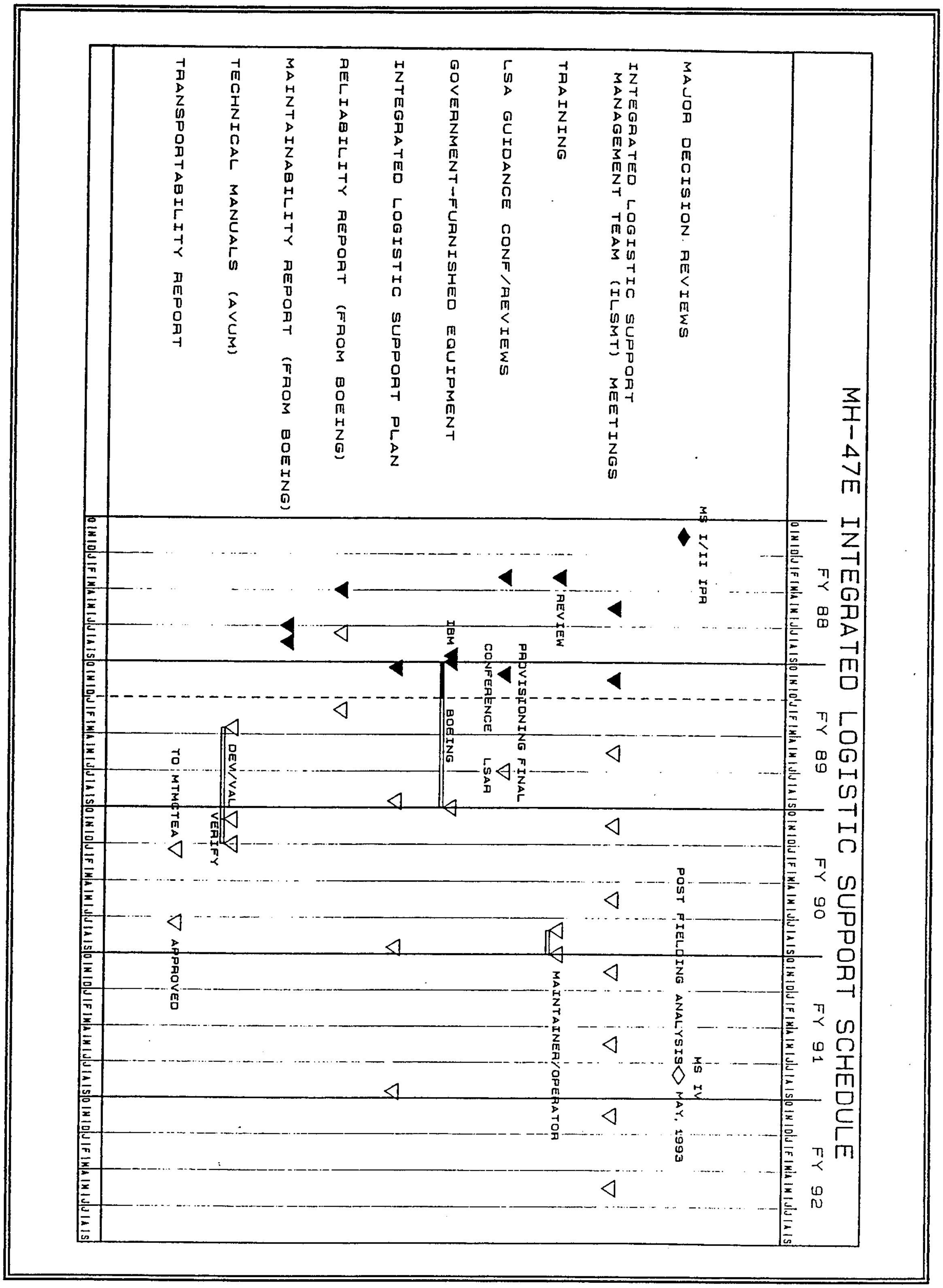


Detailed IAS Wiring Diagram From [Ref. 16]

APPENDIX C. INTEGRATED LOGISTICS SUPPORT SCHEDULES



MH-60K Integrated Logistics Support Schedule [Ref. 19]



MH-47E Integrated Logistics Support Schedule [Ref. 18]

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23. Interview Granted, Brickner, Mike, Production Manager, Boeing / Sikorsky Aircraft Services, March 1996.

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